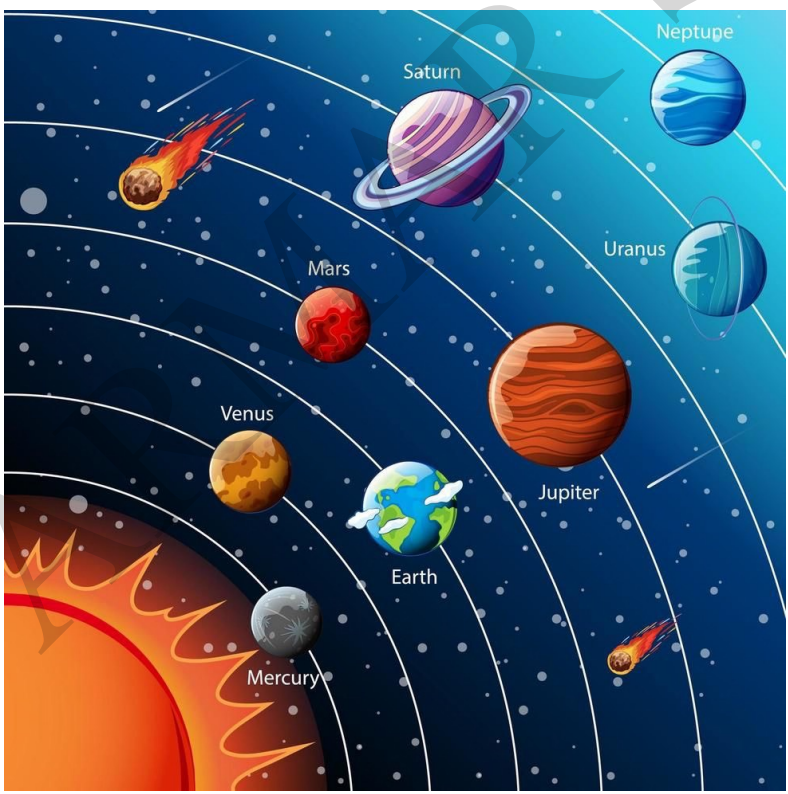
SOLAR SYSTEM



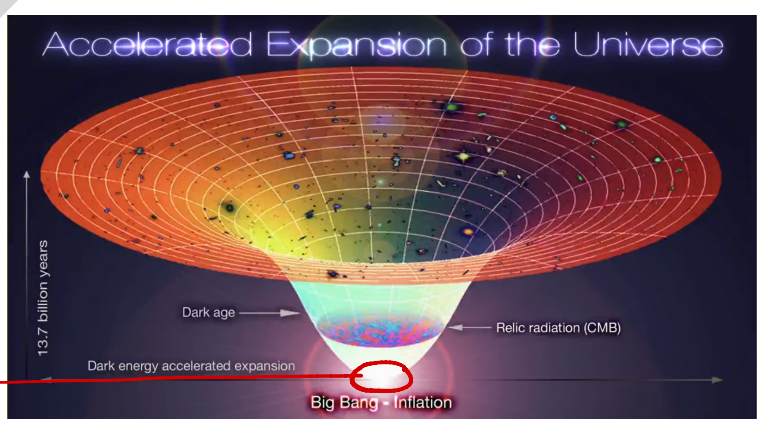
- Nearest galaxy: Andromeda Galaxy
- Study of Universe: Cosmology

Universe
↓
Milky Way Galaxy
↓
Solar System
↓
8 planets

ORIGIN OF UNIVERSE

Theories given:

- BIG BANG THEORY



Infinitely hot and dense single point ⟶ Exploded

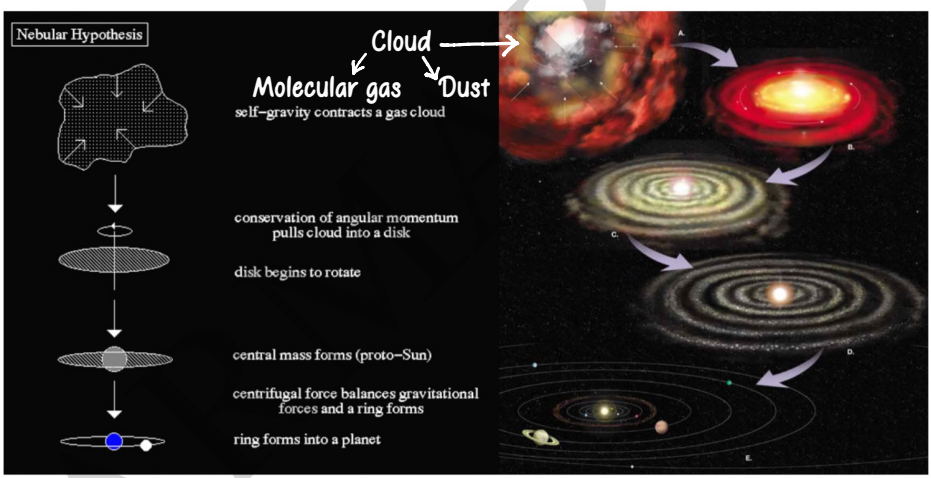
George Lemaitre: 1931
Edwin Hubble → Increase in distance of celestial bodies

Origin of Big Bang Theory. Also, known as Big Bang Explosion → Explosion → 13.8 billion years ago

→ 4.8 billion years ago

FORMATION OF OUR SOLAR SYSTEM

- Nebular Theory, 1755: by Immanuel Kant
  1796: modified by Laplace
- Nebula: A giant cloud of dust and gas



- H + H → He → Formation of Sun (mostly made of H_2 and He
  (Nuclear Fusion)
  H_2 → 70%

- Indian Institute of Astrophysics HQ: Bangalore

CELESTIAL BODIES

Two types:

- Luminous: Self-glowing, eg: stars
- Non-Luminous: Not self-glowing, but can reflect light from other sources. Eg: Moon, Asteroids, Meteor, Comets, Meteorites

1. Asteroids: they are small, rocky objects that orbit the Sun
2. Meteoroids/Meteors: enters Earth's atmosphere and burn up in Mesosphere (shooting stars)
3. Comet: Small icy dirt balls that orbit the Sun, burn upon reaching Sun
4. Stars

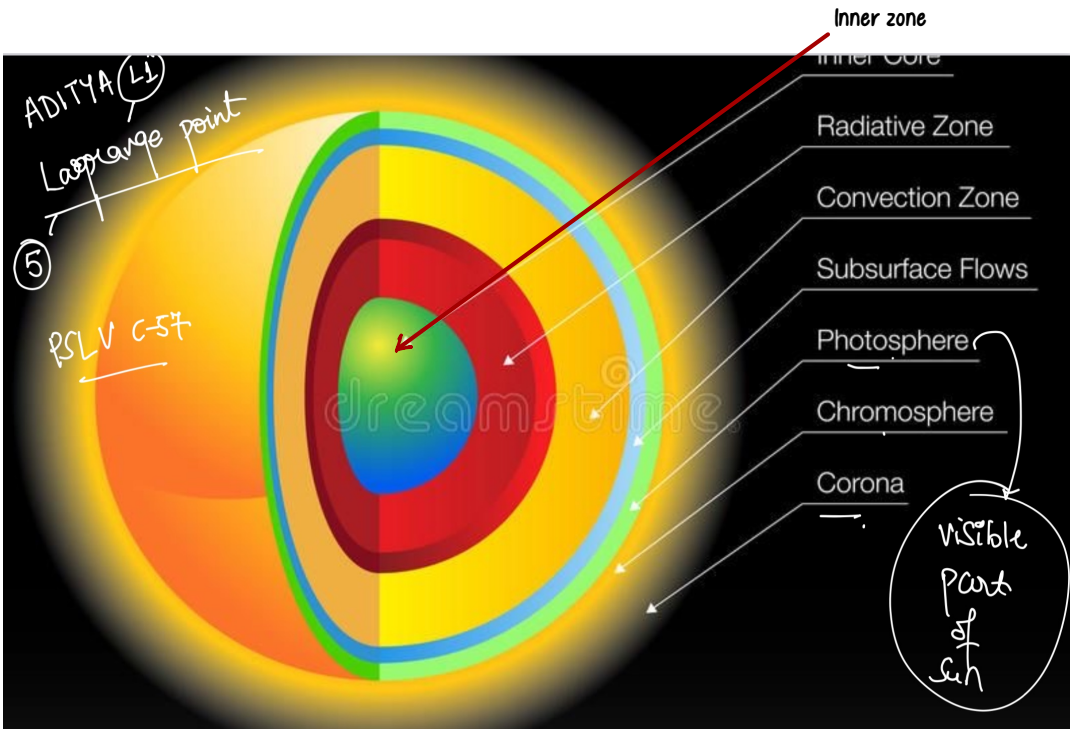
* Planetesimal Hypothesis: Theory about how planets were formed in Solar System by Thomas C. Chamberlin and Forrest R. Moulton in 1905

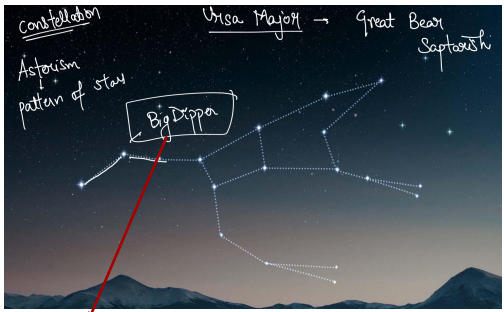
- Stars: luminous bodies
- Colour: Depends on temperature
- Group of stars: Constellation
  - Largest: Hydra
  - Urja Major: Sapta Rishi
- Brightest star in Orion Constellation: Rigel
- Brightest star in night sky (overall): Sirius (Dog Star)
- Closest star to Earth: Sun → Distance from Earth: 150 million km (1.5×10^8 km)
  - After Sun, it is Proxima Centuri
- Light Year/Parsec: celestial distances
- 1 LY: 9.46×10^{12} km
- 1 Parsec: 3.26 LY

Sun

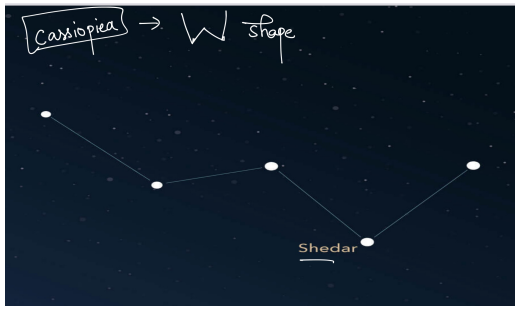
- India's first Solar Mission
  - ADITYA L1 mission ISRO, India

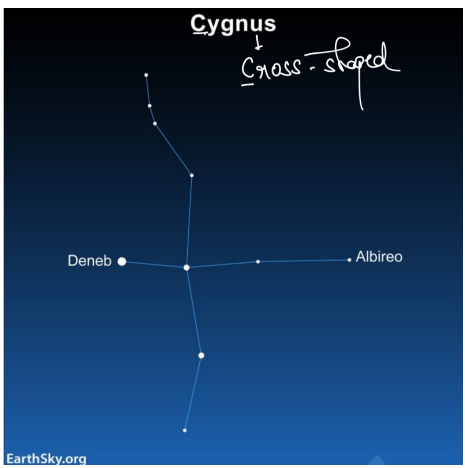
- The only star in our solar system and powerhouse of solar system
- Composed of Hydrogen (73%), Helium (25%) and other metals
- Carries 99% mass of our solar system
- Approx 109 times of Earth
- Takes 8 minutes 30 seconds for light at speed of 3 lakh km/sec to reach Earth
- Temperature at surface = 5800 K/5600 C
- Temperature at centre = 15.7 million K
- Outer layer: CORONA

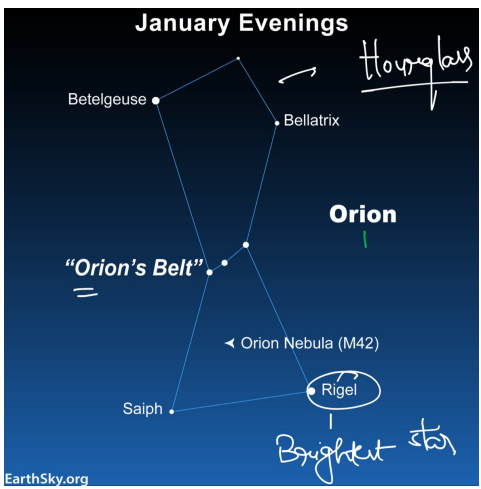

Inner zone
Radiative Zone
Convection Zone
Subsurface Flows
Photosphere
Chromosphere
Corona
ADITYA (L1)
Lagrange point
5
PSLV C-57
visible part of sun

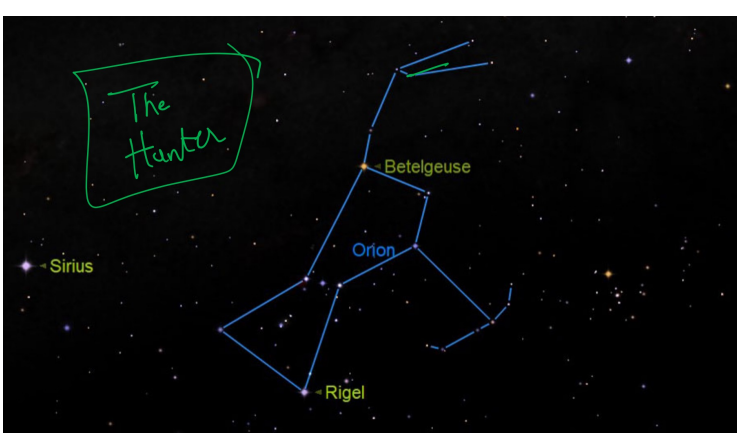


Asterism pattern formed







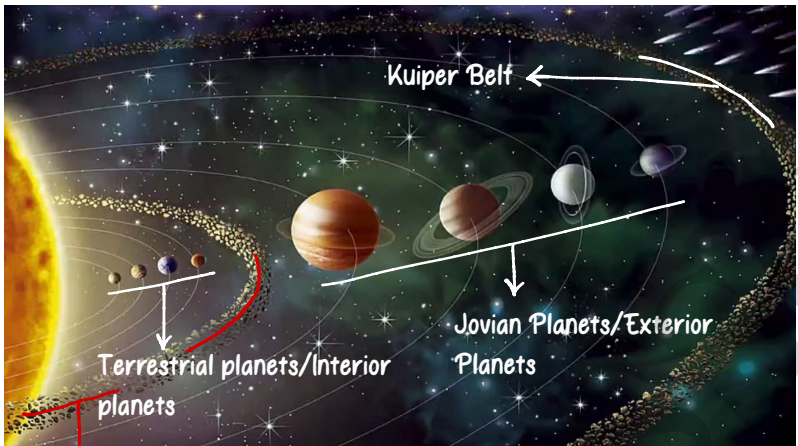


Moon

- Earth's natural satellite
- Non-Luminous
- Radii: 1.74 x 10^6 m
- Time of Moon's light, takes to reach Earth: 1.26 secs
- Distance b/w Earth and Moon: 3,84,000 km
- Gravity = $\frac{\text{Earth's gravity}}{6}$
- Rotation = Revolution (same)
  - 27.3 days → Only one side of the Moon is visible (Near side) ← 60% of it
- Rotation = Revolution → 27 days

- Rotation: object's spinning motion about its axis
- Revolution: object's orbital motion around another object
- All planets rotates from West to East (anti-clockwise) except Venus and Uranus (clockwise)

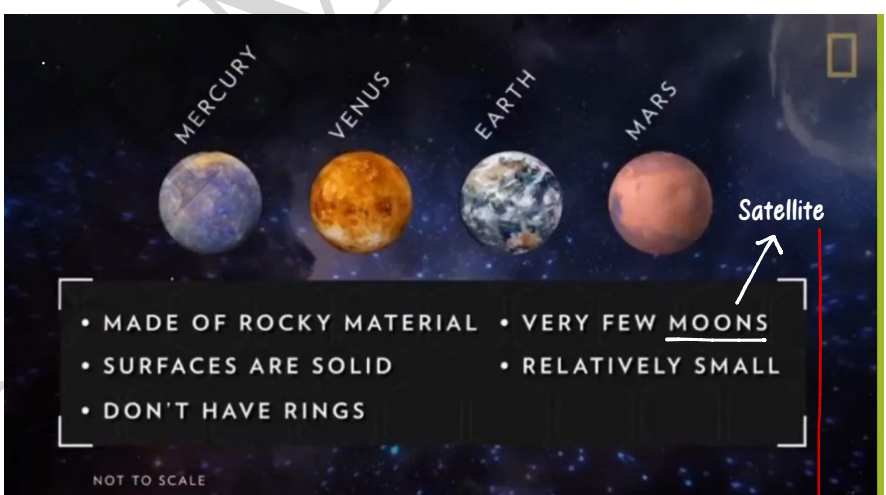
Chandrayaan 3
- Lander: Vikram
- Rover: Pragyaan
- Point: Shaktishakti point



Asteroid Belt: b/w Mars and Jupiter

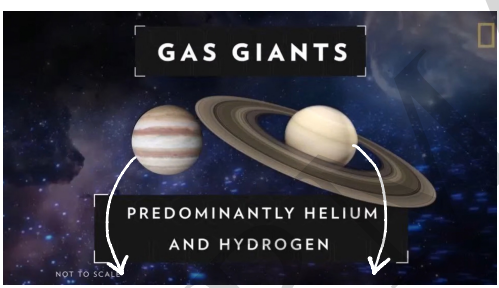
- Pandit Jasraj becomes the first Indian musician to have a minor planet named after him: Panditjasraj (300128) → Derived from his date of birth, 28 Jan 1930

- Characteristics of Terrestrial Planets



Revolves around planets

*Halley's Comet: Appears every 76 years
- First observed: 1986
- Next in 2061



Jupiter Saturn

Uranus Neptune

1st Planet: Mercury

- Closest planet to Sun
- Smallest planet in solar system
- Diameter: 4900 km
- Fastest planet, takes 88 days to complete revolution around Sun
- Planet with no satellite
- Planet with no water and gases like Nitrogen, Hydrogen, Oxygen, and Carbon Dioxide
- Fastest revolution: 88 days

2nd Planet: Venus

- Hottest planet in solar system: traps the gas easily, has thick clouds of H_2SO_4 and CO_2
- Brightest planet in Solar System, also known as "Evening Star" and "Morning Star"
- No satellite/Moon
- Also known as "Earth's Twin" due to similar mass and size
- Rotates clockwise
- Slowest rotation: 243 days

* Venus is also known as Lucifer (light bearer)

3rd Planet: Earth → Closest planet to Earth: Venus and Mercury

- the only planet to give support to life
- Also known as "Blue Planet": 70% water
- It has one satellite: Moon
- Densest in the entire solar system

4th Planet: Mars

- Known as "Red Planet": rich in Iron oxide (red soil)
- Second smallest planet in solar system
- Two natural moons: Phobos and Deimos
- Largest Volcano and tallest mountain of Mars: Olympus Mons

5th Planet: Jupiter

- Largest planet with shortest rotation- 10 hours (9 hrs 56 mins)
- Atmosphere filled with: Hydrogen, Helium, other gases
- Third brightest after Moon and Venus
- At present total moons: 95 moons at present
- Largest satellites: Io, Europa, Ganymede (largest among all), Callisto (all discovered by Galileo)
- Has unclear ring around it
- It is known as "Winter planet"

6th Planet: Saturn

- Second largest planet
- Has bright and concentric rings made of tiny rocks, gas, dust, ice
- It is the least dense planet
- Has 146 moons at present (the maximum)
- Largest satellite: Titan
- 1655: Huygenes (discover Saturn's rings)
- 1675: Cassini (discovered gap b/w rings)
  - Cassini divisions

* Titan and Enceladus (satellites of Saturn) show possibilities of life on Saturn

7th Planet: Uranus

- It is greenish in colour: "Green Planet" due to presence of Methane (CH_4)
- Discovered by William Herschel in 1781
- Known as "Ice Giant"
- Atmosphere has: Hydrogen, Helium, Water, Ammonia, Methane
- Rotates clockwise like Venus
- Coldest planet
- Its is tilted to 98° at its axis– Rolling/Lopsided Planet (Due to its tilt)

8th Planet: Neptune

- Farthest planet → Shortest revolution: 165 yrs
- It is also "Ice Giant"
- Atmosphere composed of: Hydrogen, Helium
- Bluish in colour due to Methane
- Fourth largest planet and third most massive planet
- Discovered by: Johann Galle and Urbain Le Verrier in 1846 (only planet found by Mathematical Predictions)
- Has 14 satellites, famous moon: Triton
- It is the windiest planet

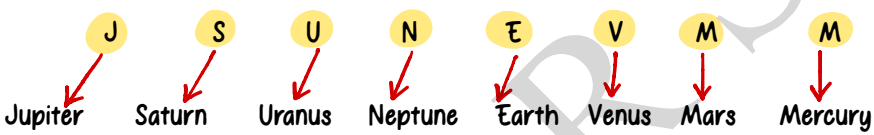
* Neptune
  - 1 day = 16 hrs

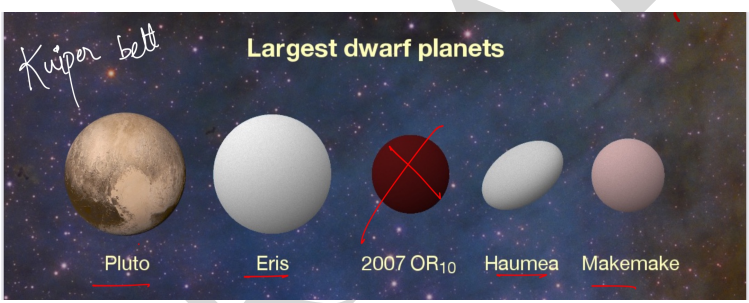
Pluto

- No more a planet in 2006 by International Astronomical Union (IAU) → HQ: Paris, France
- It is known as dwarf planet and is a member of Kuiper Belt
- Kuiper Belt is a spherical boundary outside the orbit of Neptune containing a number of asteroids, rocks and comets

- Pluto's largest satellite: Charon
- 1 revolution = 248 Earth years

Increasing to Decreasing Order





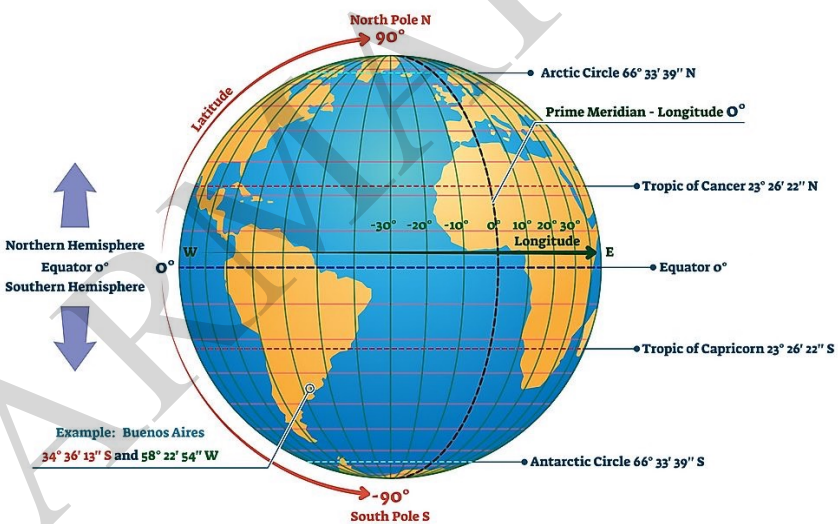
Three characteristics of dwarf planets are:

1. To be in orbit around the sun
2. Have a nearly spherical shape
3. Should not be able to clear their orbit of debris

- Supernova: Explosion of star
- Pulsar: A neutron star
- Black hole: A place in space with immense gravity

- Pluto: Largest and brightest dwarf planet
- Eris: Second largest dwarf planet
- Makemake: Third largest and it orbits in 310 yrs
- Ceres: Dwarf planet present in asteroid belt
- Haumea: Fastest rotating in Kuiper belt

LONGITUDE AND LATITUDE
ROTATION AND REVOLUTION



Fundamentals of Earth

Phase 4: Eclipse

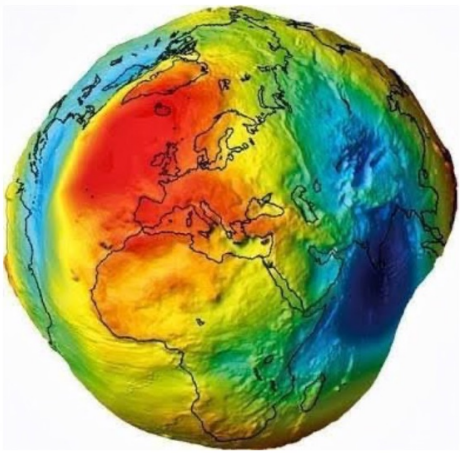
Age of Earth

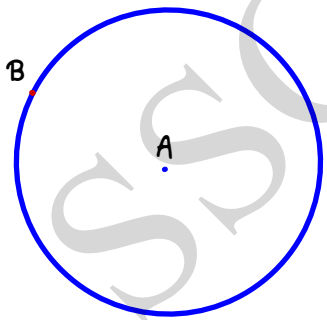
Technique used: Radioactive dating → invented by Ernst Rutherford (1905)

Types of Dating

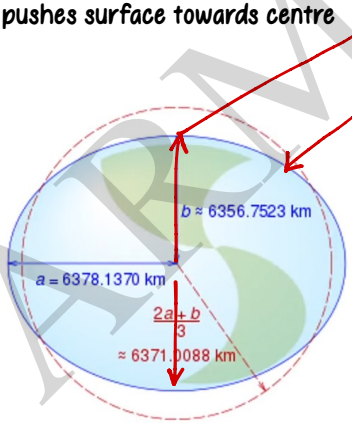
1. Uranium-lead dating method (oldest rocks)
2. Potassium-argon method
3. Rubidium-strontium method
4. Radiocarbon dating method
5. Chlorine-36 dating method
6. Carbon-dating (C^{14}) (latest rocks)

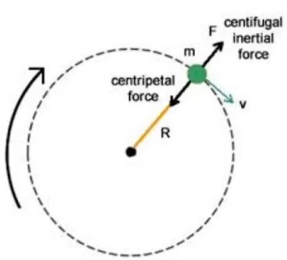
Shape of Earth





- Shape of Earth is Geoid or Oblate Spheroid (a little flat from top and bottom)
- Reason: more Centrifugal Force at Equator bulges earth at Centre and Gravitation force at poles pushes surface towards centre due gravitational force towards the centre, it flat in top and bottom

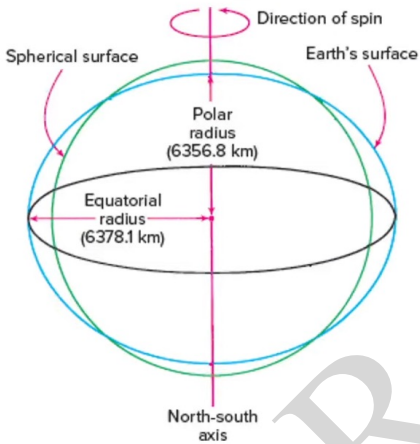


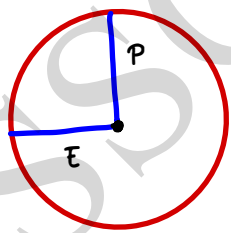


When a body revolves, two types of forces is applicable

- Centripetal Force: towards the axis of rotation or centre of curvature (inside)
- Centrifugal Force: directed away from the centre of the circle

Radius of Earth



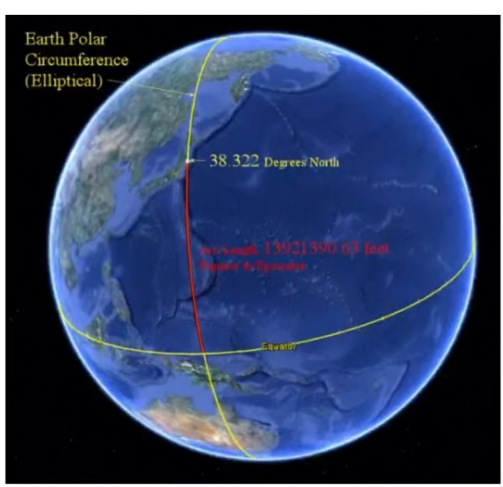


- Equatorial Radius: 6378 km
- Polar Radius: 6357 km
- Mean Radius: 6371

Why polar radius < Equatorial radius?

- Ans: Earth is bulged at the equator and flattened at the poles

Circumference of the Earth

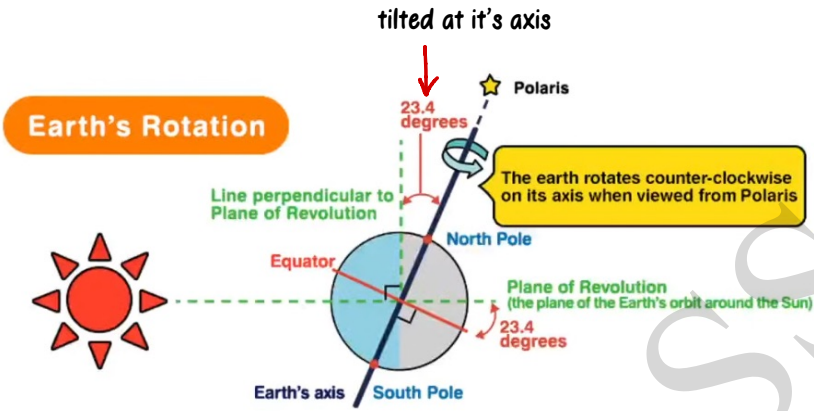


- Polar: 40,007 km
- Equatorial: 40,075 km
- Mean: 40,040 km

Why poles circumference < Equatorial?

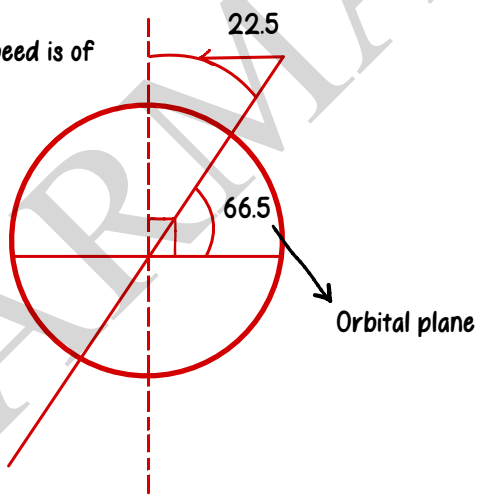
- Earth is bulged at equator and flattened at the poles

Rotation of Earth

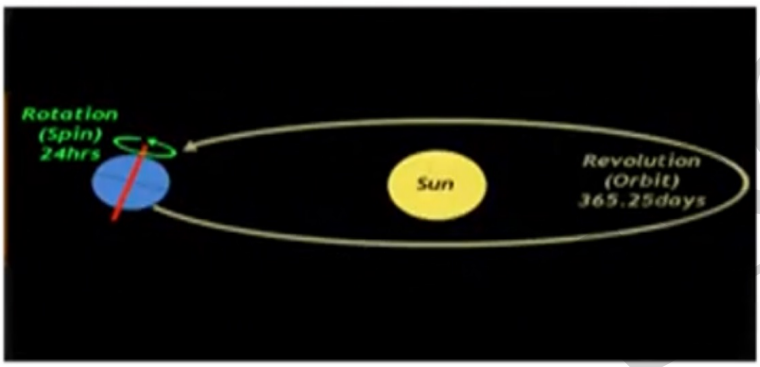


- Rotation: spinning on its own axis
- One rotation of Earth: 23 hour 56 mins 4 sec
- Direction: West to East
- Rotational Speed is maximum at Equator and minimum at Poles

Fastest rotation speed is of Jupiter



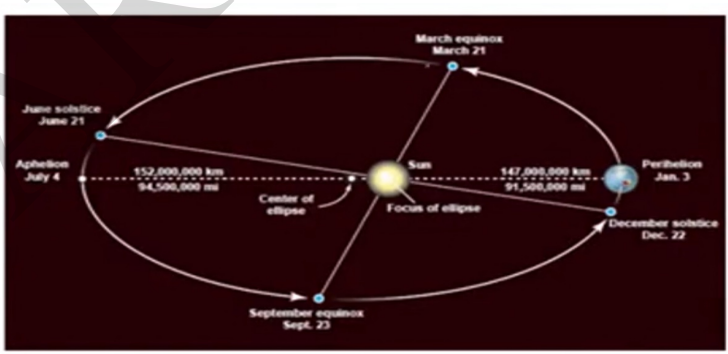
Revolution of Earth



- Revolving around the Sun in Elliptical orbit
- One revolution: 365 days 6 hours 9 minutes and 9 sec
- Orbital speed: 29.8 km/sec
- Max orbital speed: Mercury
- Min orbital speed: Neptune

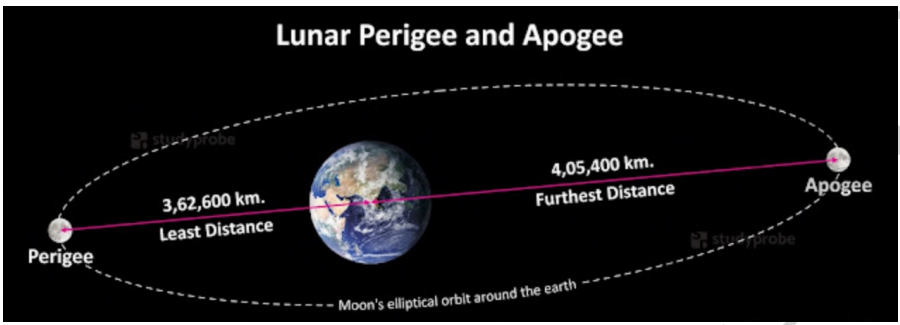
6 x 4 = 24 hrs → Leap year concept (366 days)

Distance from the Sun

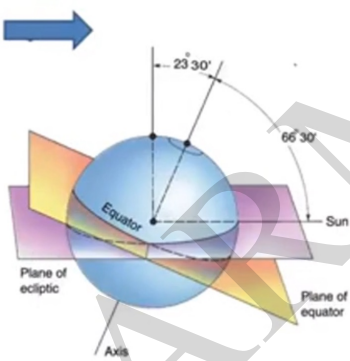


- When nearest to Sun: Perihelion (January 3rd – 14,75,00,000 km)
- When farthest from Sun: Aphelion (July 4 – 15,25,00,000 km)

- Perigee: the point of moon's orbit when it is closest to Earth
- Apogee: When moon is farthest from Earth



Inclination of the Earth's axis



- Axial Inclination: Inclination of Earth on its axis = $23\frac{1}{2}^{\circ}$
- Orbital Inclination: Inclination of Earth on its orbital plane = $66\frac{1}{2}^{\circ}$

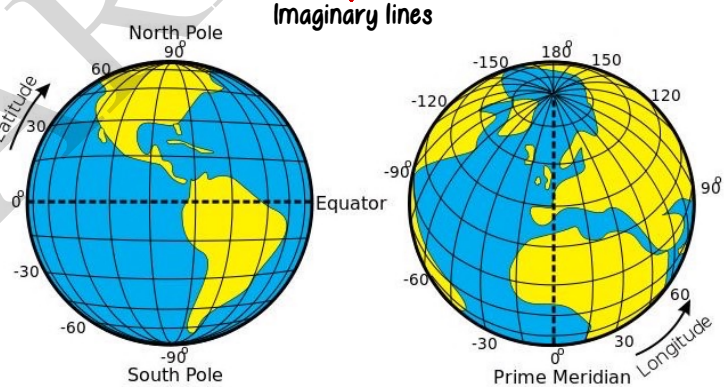
Hemisphere

- Equal division of Earth in two parts
- Equator: divides the globe horizontally into 2 equal parts – Northern and Southern Hemisphere
- Prime Meridian and International Date Line: divides the globe vertically – Eastern and Western Hemisphere

Latitude and Longitude

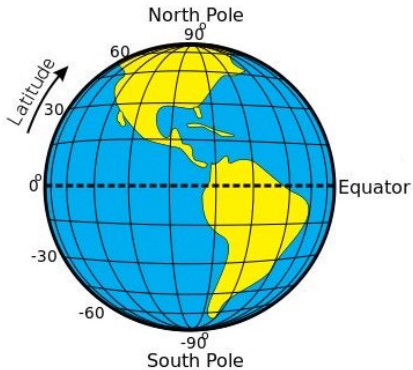
↓

Imaginary lines



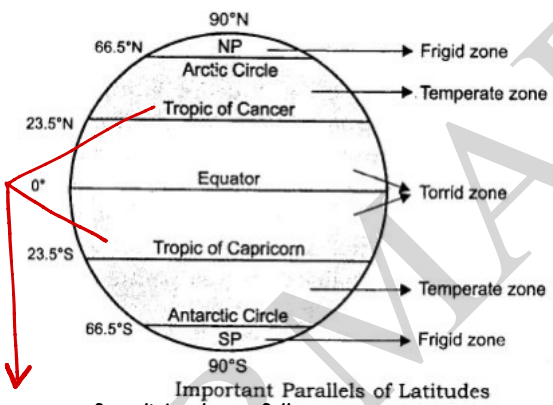
Horizontal lines

Vertical lines



Latitude

- Imaginary horizontal lines on the globe that run from East to West
- Angular Distance of a place from the equator
- 1 degree of latitude = 111 km (approx)
- Total latitudes: 181
- Distance b/w each latitude is same

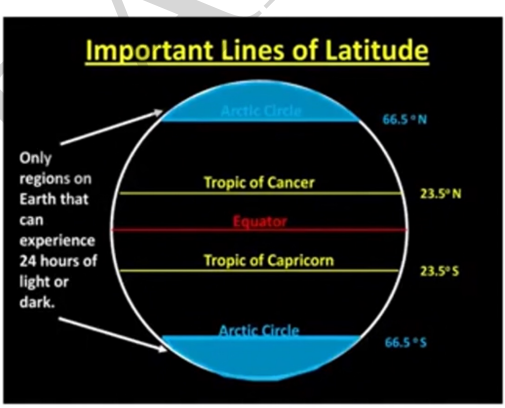


Important Parallels of Latitudes

Direct ray of sunlight do not fall beyond these tropics

Important Latitudes:

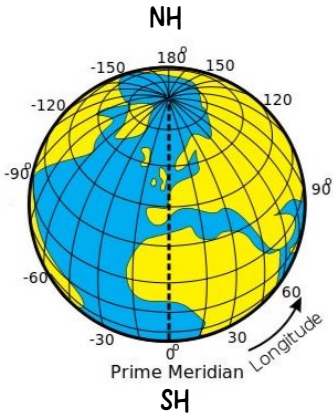
- 0 : Equator
- $23\frac{1}{2}$°N: Tropic of Cancer
- $66\frac{1}{2}$°N: Arctic Circle
- $23\frac{1}{2}$°S: Tropic of Capricorn
- $66\frac{1}{2}$°S: Antarctic Circle
- Largest latitude: Equator
- Smallest latitude: Poles (North and South)



Uses

1. In Climatology:
- Temperature zones, wind
- Responsible for Pressure System
- Planetary Winds System

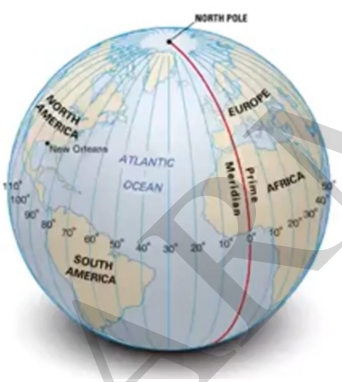
2. Location of place



Longitudes

- Imaginary vertical lines over the globe that run North to South
- Angular Distance of a plane from Prime Meridian
- Distance from each longitude varies from poles towards equator
- Least distance at poles and maximum distance at equator: 111.32 km
- Total longitudes: 360

*
- All longitudes divide Earth into 2 equal parts
- All longitudes are Great Circle (circle in case of longitudes)



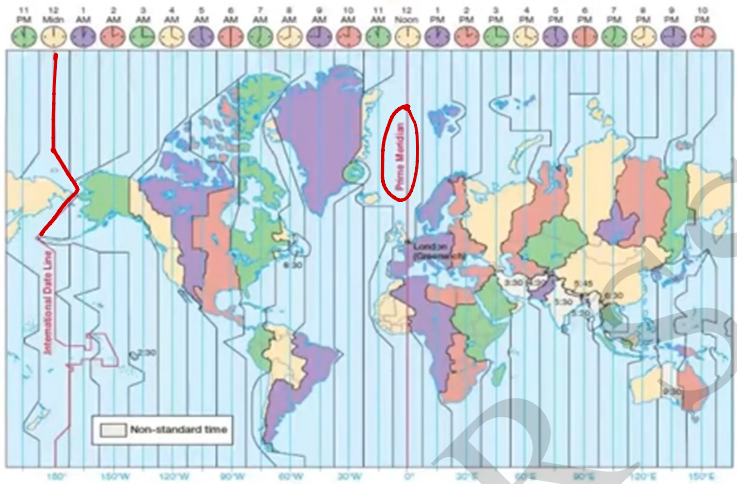
Important Meridians

- Prime Meridian: 0 degree longitude (passes from Greenwich, London)
- International Date Line: 180 degree Meridian

↓

Zig-Zag lines

International Date Line



Prime Meridian

- It passes through Greenwich in London
- Countries: 8
  - UK
  - France
  - Spain
  - Algeria
  - Mali
  - Burkina Faso
  - Togo
  - Ghana

- TRICK: BSF GAMe in TOGO Kingdom

$360^\circ = 24$ hrs

$\frac{360^\circ}{24} = 1$ hr

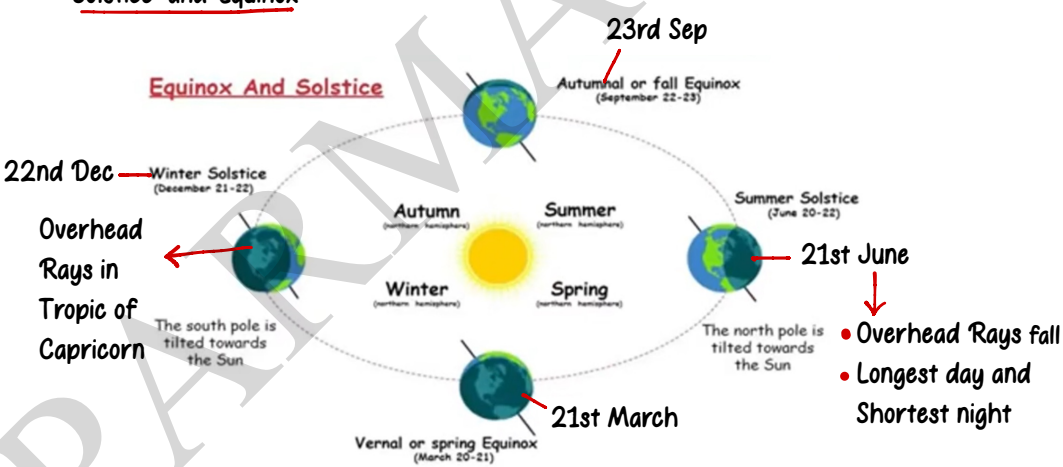
$15^\circ = 1$ hr

$15^\circ = 60$ mins

$1^\circ = \frac{60}{15} = 4$ mins

- Moving East away from prime meridian, will increase the time by an hour for every 15°, consecutively if we move to West from the prime meridian, the time will decrease by an hour

Solstice and Equinox



- Overhead Rays fall
- Longest day and Shortest night

- Day and Night: due to Rotation
- Seasons:
  1. Revolution
  2. Tilt

Solstice

Summer – June 21

1. Vertical rays on Tropic of Cancer
2. Northern Hemisphere gets more heat
3. Continuous sun rays on North Pole for 6 months, continuous days
4. known as Kark Sankranthi

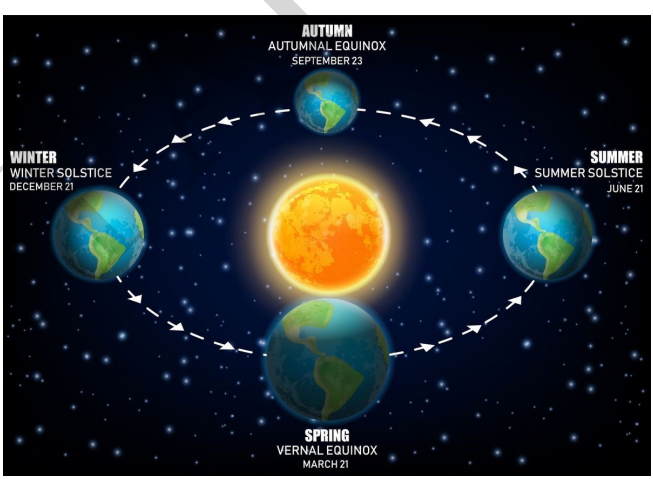
Insolation: incoming solar radiations

Winter – Dec 22

1. Vertical rays on Tropic of Capricorn
2. Southern Hemisphere gets more heat
3. Continuous Sun rays on South Pole for 6 months, continuous daylight
4. known as Makar Sankranthi

Equinox

- Direct rays of the Sun fall on the Equator
- At this position neither of the poles is titled towards the Sun
- So, the entire Earth experiences Equal days and nights

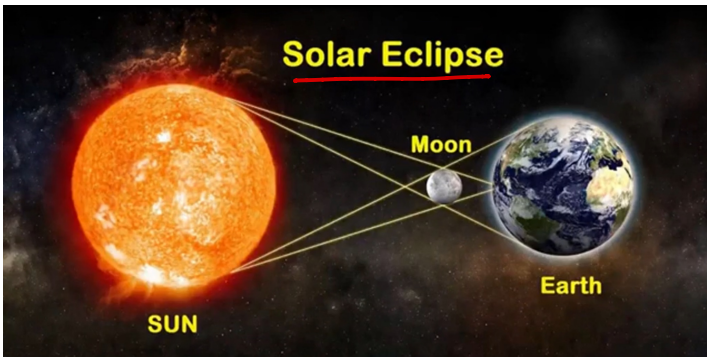


Vernal Equinox

- March 21: It is spring in the NH and autumn in the SH

Autumnal Equinox

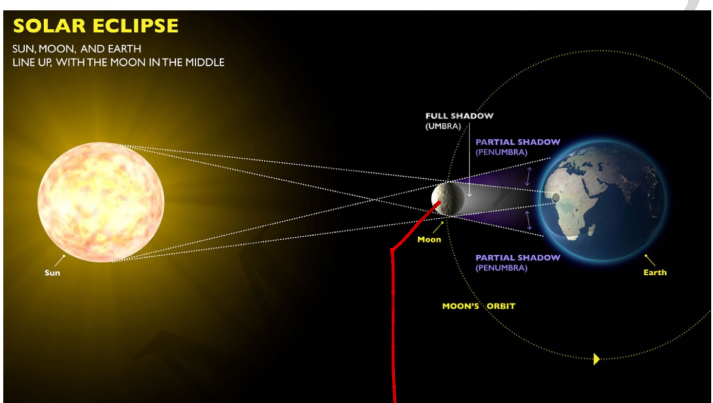
- Sep 23: it is autumn in NH and spring in SH



- Sun (at its constant position) is obscured by the moon

↓

New Moon
- Amavasya



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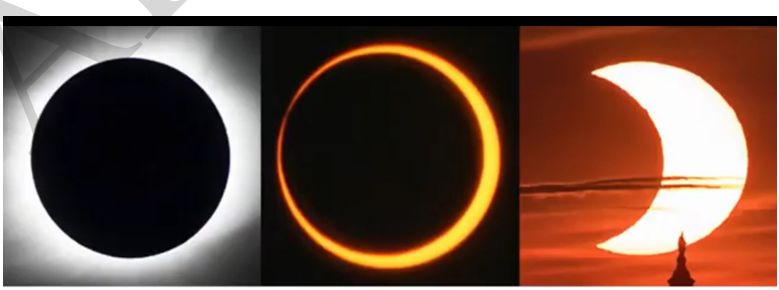
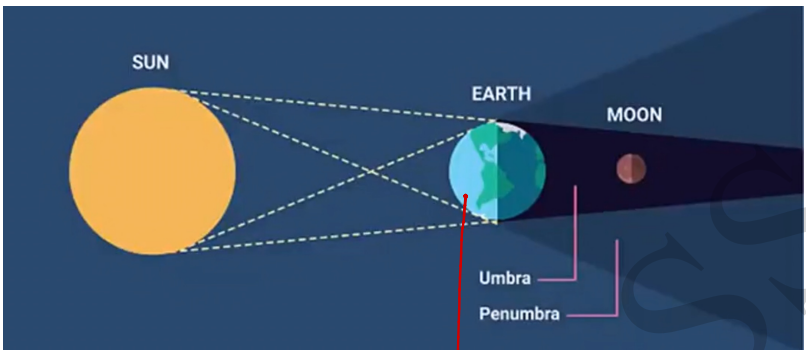
Moon is blocking Sun's light



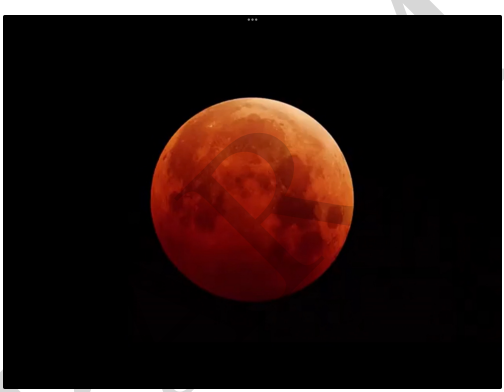
Total Solar Eclipse | Annular Solar Eclipse | Partial Solar Eclipse

Lunar Eclipse

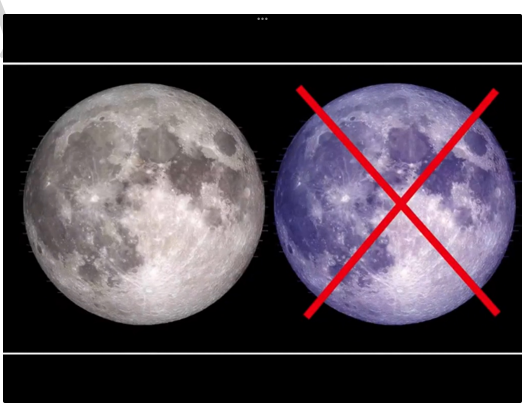


- Full Moon condition- Purnima

Earth blocks Sun's light
(light refraction) → scatters more
causing blue colour
light to vanish and red → scatters less
light to reach moon



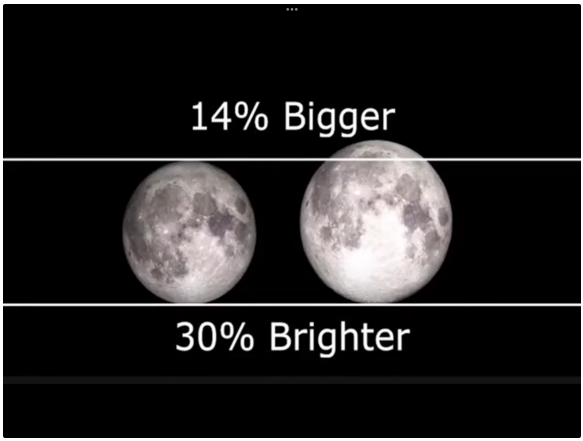
Red Moon



Blue moon

↓

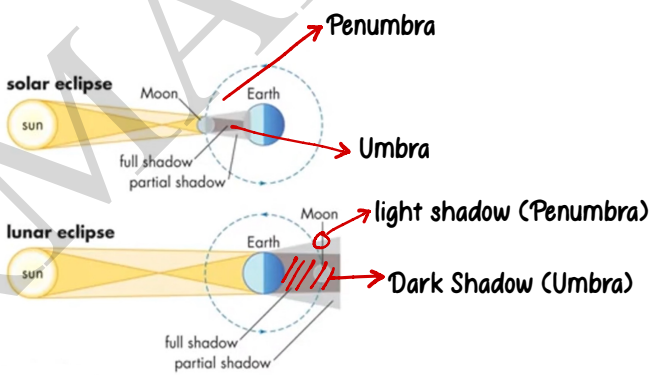
2 full moon in a month



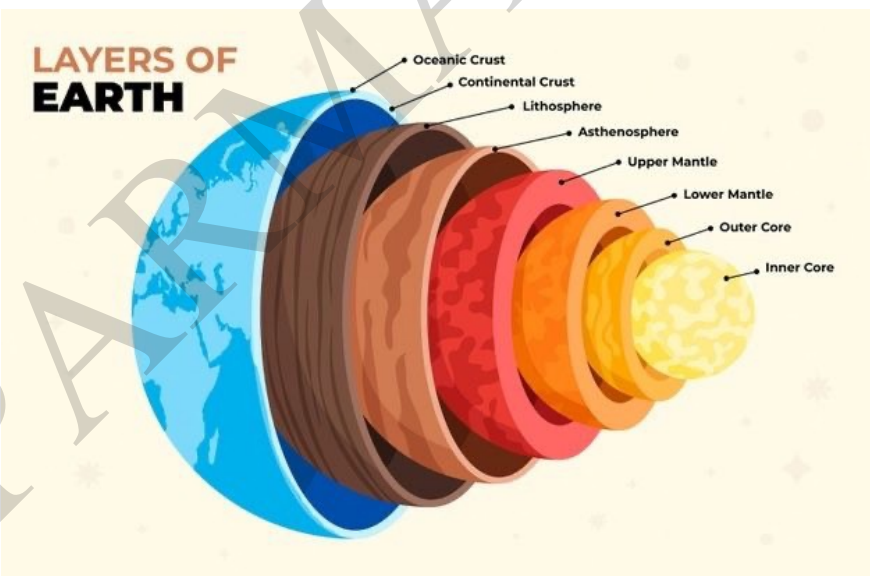
- Lunar Eclipse + Perigee → Moon appears bigger than its normal size

↓

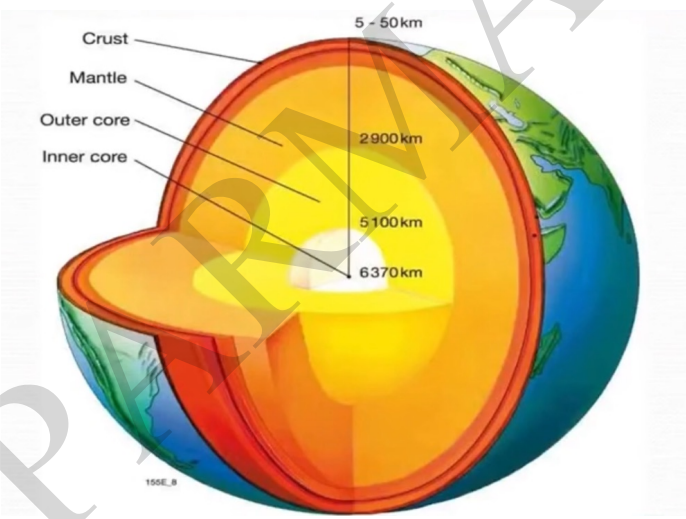
Super Moon condition



Earth's Interior
&
Plate Tectonic



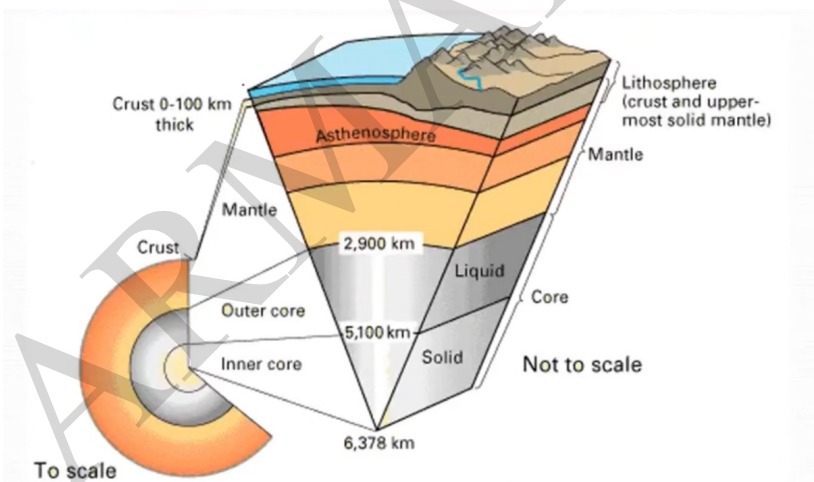
Earth's Interior

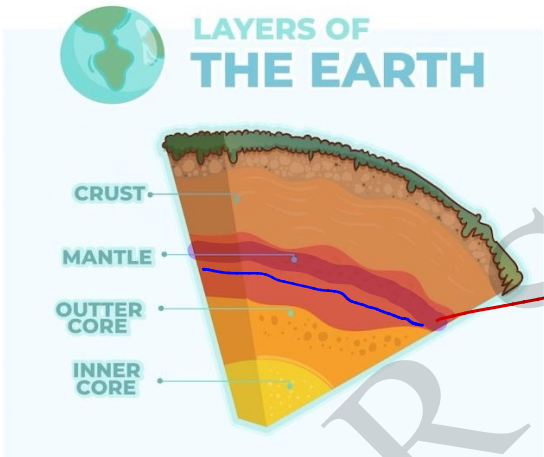


Four method's to know Earth's interior:

1. Temperature – indirect source
2. Volcanoes and rock – direct source
3. Meteorites – indirect source
4. Earthquakes – indirect source


Temperature
Volcanoes
Meteorites
Earthquakes


Crust 0-100 km thick
Lithosphere (crust and upper-most solid mantle)
Asthenosphere
Mantle
Mantle
Crust
2,900 km
Liquid
Core
Outer core
5,100 km
Inner core
Solid
Not to scale
6,378 km
To scale



Crust: made of Silica and Aluminium layer (SiAl)

- Thickness: 5–70 km

Two divisions:

1. Continental Crust:

- land part of crust
- 30 km (thick/lighter)
- made of Granitic rock

2. Oceanic Crust:

- water part of crust
- 5 km (thin/denser)
- made of Basaltic rock

Composition of Earth's crust:

- O → 46.4%
- Si → 28%
- Al → 8% (most abundant metal in crust)
- Fe → 5% (2nd most abundant)

Mantle: made of Silica and Magnesium (SiMa)

- Thickness: 2900 km
- Top layer: Solid form

Two divisions:

1. Upper Mantle
2. Lower Mantle

- Asthenosphere: semi-molten form (plastic form)

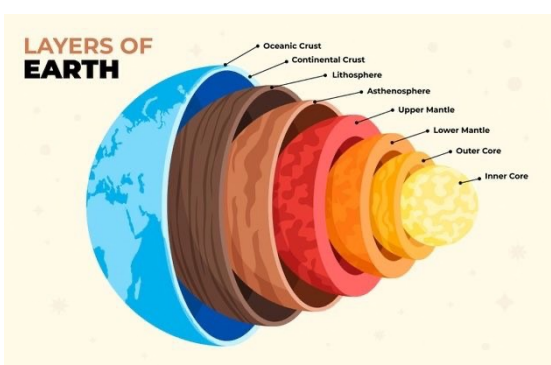
Core: made of Nickel and Iron (NiFe)

Two divisions:

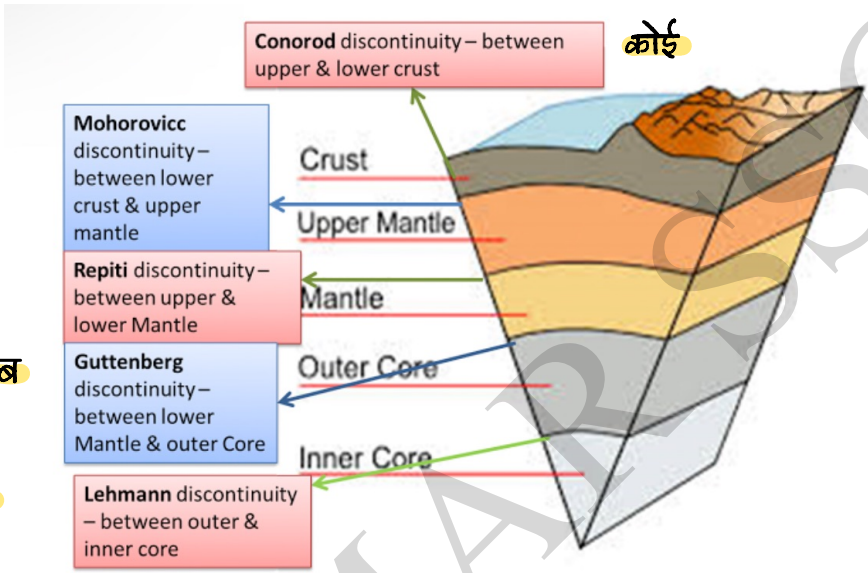
1. Inner Core: Solid form – 2200 km
2. Outer Core: liquid form (shows magnetic properties) – 1300 km

	Crust	Mantle	Core
By Volume	1%	84%	15%
By Mass	1%	68%	31%

- Lithosphere: Crust + Upper solid part of Mantle – thickness: 10–200 km
- Asthenosphere is not part of Lithosphere



Earth's Discontinuity



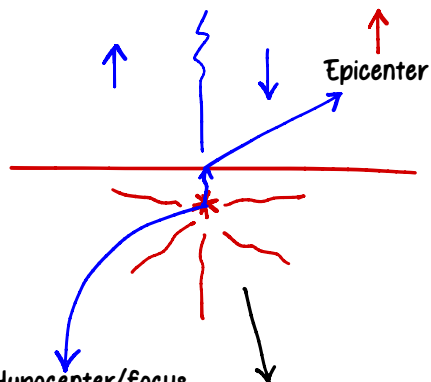
कोई
मुझे
Red
गुलाब
लाटो

S. No	Discontinuity	Layers	Depth
1.	Conrad	Outer and Inner Crust	45 km
2.	Moho	Crust and Mantle Inner Crust and Outer Mantle Inner Crust and Asthenosphere	100 km
3.	Repiti	Outer Mantle and Inner Mantle	700 km
4.	Gutenberg-Weichart	Mantle and Core Inner Mantle and Outer Core	2900 km
5.	Lehmann	Outer Core and Inner Core	5200 km

Earthquake

- An Earthquake is intense shaking of Earth's surface, which causes shifting of Earth's plate

Distance nearest to Epicenter = more destructruction



Hypocenter/focus (Place from where energy is released first)

Energy released due to movement of plates on the form of waves

Earthquake/Seismic waves

- Seismograph: an instrument that records earthquake waves

Waves

Body Waves → Rocks → Surface Waves/Love waves/L-waves

Rayleigh waves

- First to reach on surface
- 7-8 km/sec

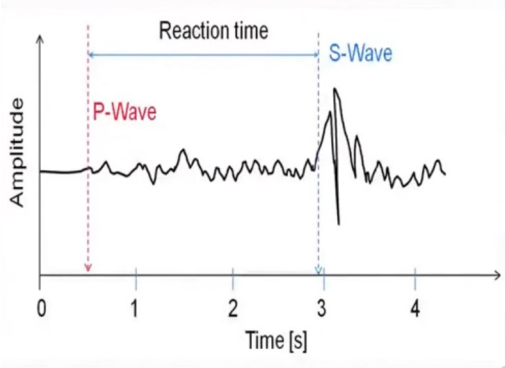
4-6 km/sec

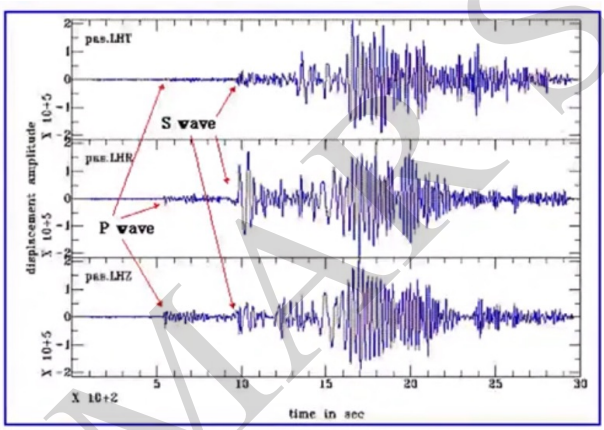
causes more destruction

P waves
- Travels fastest
- Longitudinal

S waves
- Transverse
- Can travel only in Solid medium

Speed ratio:
- Solid > Liquid > Gas (through all mediums)
- They resemble Sound Waves





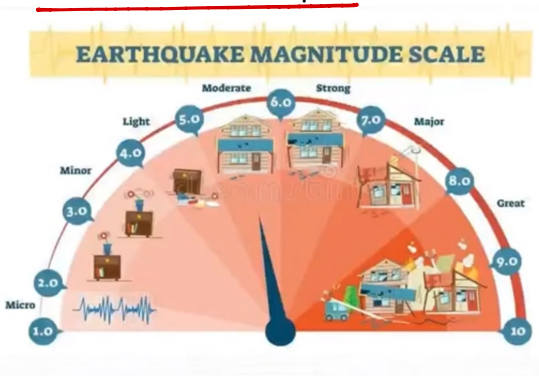
S waves

- creates Crest and Trough

P waves

- creates Compression and Rarefaction
- causes stretching and squeezing

Scales to measure Earthquake



Richter Scale

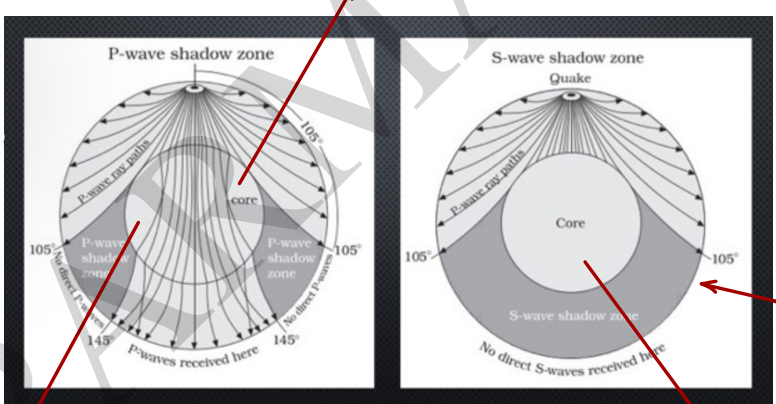
- Instrument to measure magnitude of Earthquake
- Magnitude: 0–10
- It is a limitless scale

Mercalli Scale

- Instrument to measure intensity of Earthquake
- intensity : 1–12

Shadow zone of waves

Liquid outer core

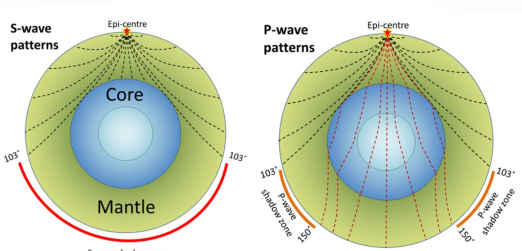


Large shadow zone

- 40% of Earth's surface (not recorded)

Slow speed

Liquid outer core



Tectonic plates

- Lithosphere makes plates comprising Crust and upper solid part of Mantle
- 7 Major + few minor plates

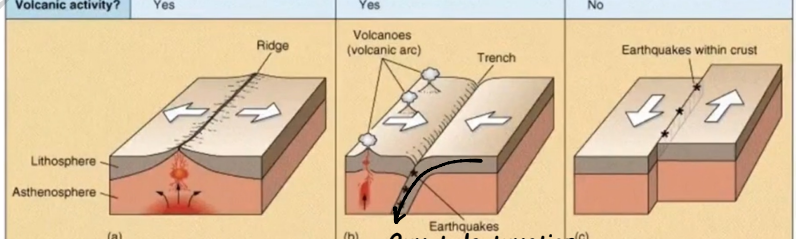
Large boundary: major plate

Minor boundary: minor plate

- Major plates marked in red
- Minor plates marked in blue

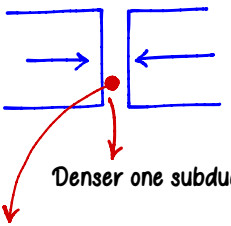
Different types of plate boundaries

Type of Margin	Divergent	Convergent	Transform
Motion	Spreading	Subduction	Lateral sliding
Effect	Constructive (oceanic lithosphere created)	Destructive (oceanic lithosphere destroyed)	Conservative (lithosphere neither created or destroyed)
Topography	Ridge/Rift	Trench	No major effect
Volcanic activity?	Yes	Yes	No



Crust destruction

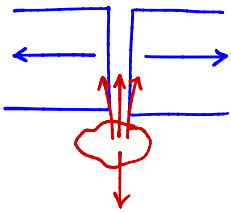
Convergent



Denser one subducts

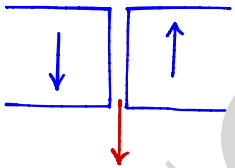
Subduction zone created
Asthenosphere melts
the crust causing crust
destruction

Divergent



distance created, causing lava to explode
New crust formation –
Constructive boundary

Conservative



Lateral Sliding
Conservative boundary

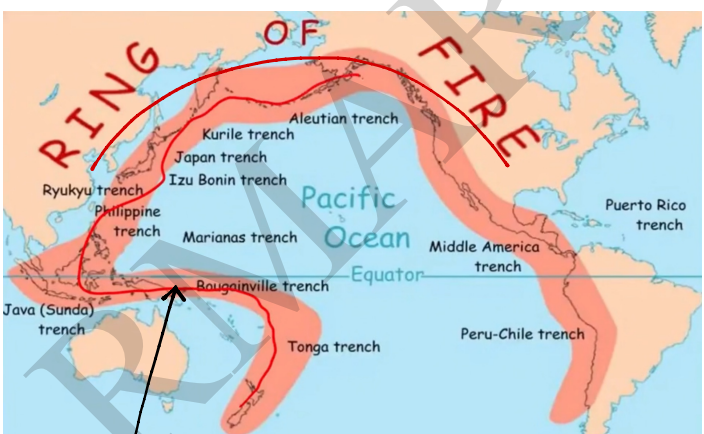


Plate boundary created,
these places are called–
Ring of Fire in Pacific
Ocean

Force behind plate movement:

- Convection occurs in the asthenosphere
  - The heat from the earth's interior causes currents of hot rising magma and cooler sinking magma to flow, moving the plates of the crust along with them

Seismic Zones in India-

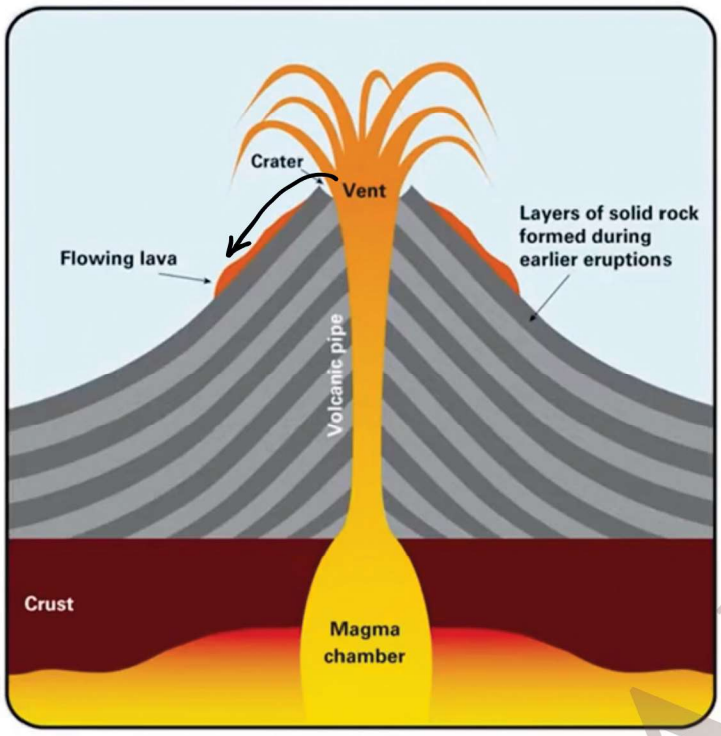
Seismic Zone Map of India: -2002

About 59 percent of the land area of India is liable to seismic hazard damage

Zone	Intensity
Zone V	Very High Risk Zone Area liable to shaking Intensity IX (and above)
Zone IV	High Risk Zone Intensity VIII
Zone III	Moderate Risk Zone Intensity VII
Zone II	Low Risk Zone VI (and lower)

ROCKS, CONTINENT AND OCEANS

Petrology: Study of rocks

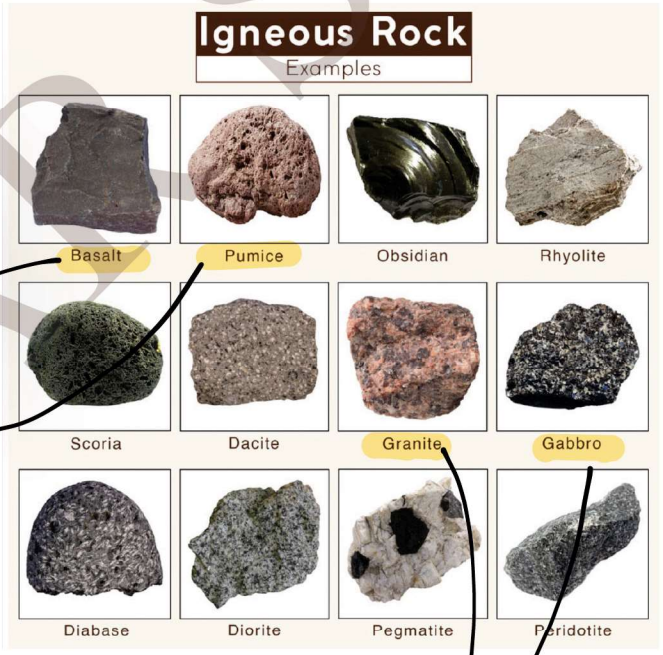


How are rocks formed?

Igneous Rocks: formed when magma cools and solidifies

Types:

1. Intrusive: solidifies inside
2. Extrusive: solidifies outside



Rock

Exogenous agents act upon eg: wind, water

Extrusive igneous rock

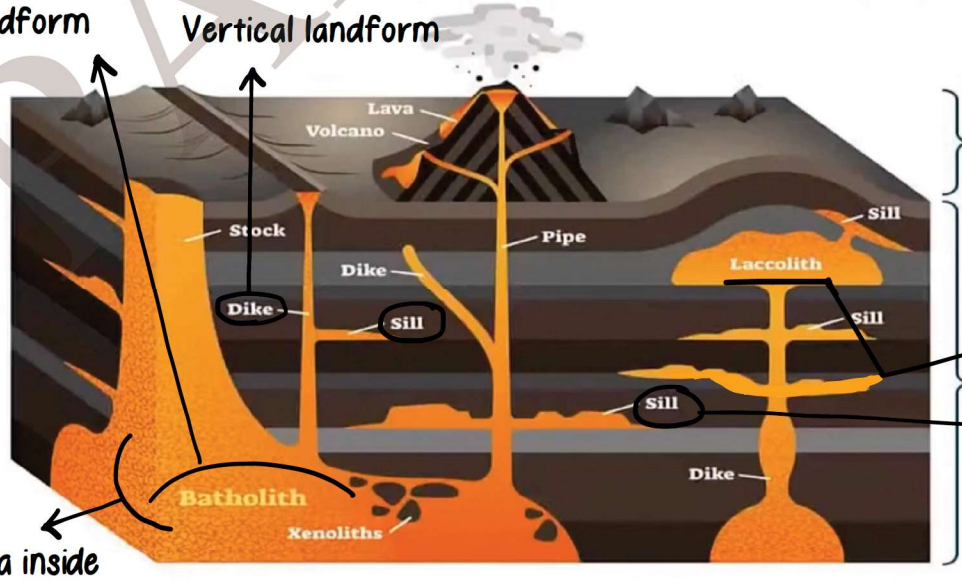
Intrusive igneous rock/plutonic rocks

- Granite: Continental crust
- Basalt: Oceanic crust

PLUTONIC BODIES

Domed shaped landform

Vertical landform



Phacolith

Horizontal Landform

Magma inside

Sedimentary Rock: Sediments are broken, transported, and deposited

- They exists in layers/strata
- In sedimentary compaction takes place – Lithifaction
- Fossils are found in it

Types:

1. Formed mechanically, eg: Sandstone, limestone and shale
2. Formed organically, eg: chalk, limestone, coal
3. Formed chemically, eg: Limestone, halite

Metamorphic Rock: These rocks are formed by recrystallisation and reorganisation of materials within the original rocks

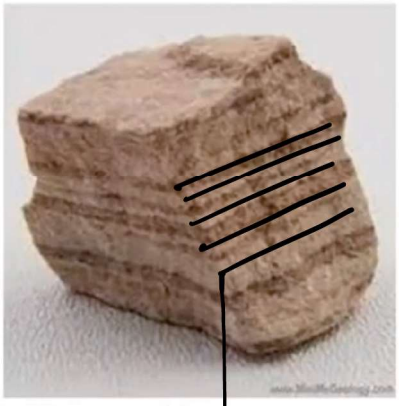
Igneous + Sedimentray → Metamorphic

↓

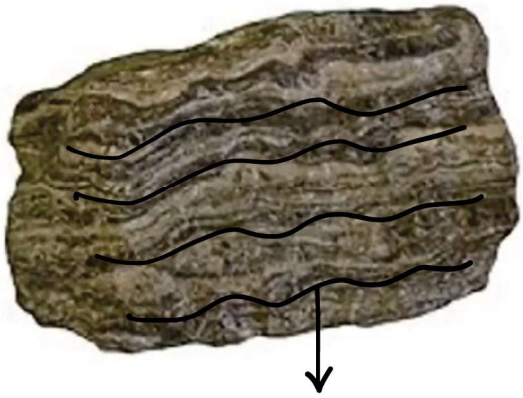
Pressure
Volume
Temperature
} change in forms → Metamorphosis

Types:

1. Thermal Metamorphism: metamorphic rocks formed due to a sudden temperature change
2. Dynamic Metamorphism: metamorphic rocks formed without any chemical change



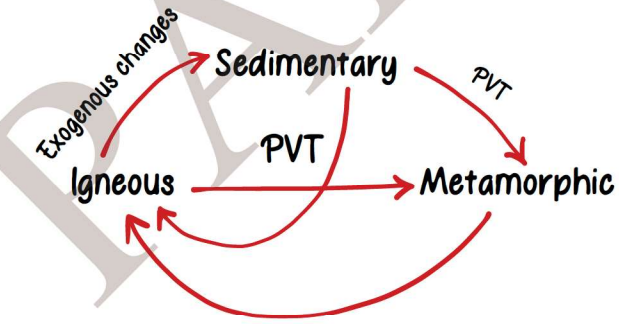
Alternate dark and light bands called **banding**



Lines formed called **Lineation**

- Granite → Gneiss (PVT changes) → Metamorphic
- Shale → Slate → Metamorphic
- Sandstone → Quartzite → Metamorphic
- Limestone → Marble / Schist / Amphibolite → Metamorphic

Rock Cycle



Volcano

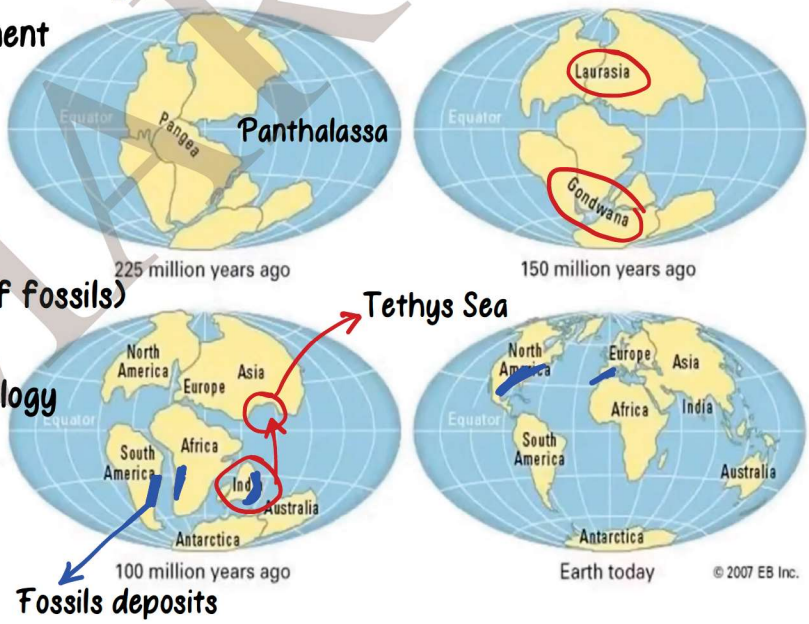
Types:

1. Cinder
2. Composite: most viscous lava
3. Shield: low viscosity lava
4. Caldera: most explosive lava, collapses on itself

Continents and Oceans

- Alfred Wegener: Gave Continental Drift Theory, 1912

All of the modern-day continents had previously been clumped together in a supercontinent called Pangaea and the water body is called Panthalassa



→ Evidences:

- Jig Saw fit
- Fossils deposits: Palaeontology (study of fossils)
- Placer deposits

Study of rock: Petrology

Types of rocks

Soft — eg: Talc

Hard — eg: Diamond

Fossils deposits

- Continental drift due to (as assumed by Alfred Wegener)
  1. Tidal force
  2. Polar fleeing force

But it occurs due to development of convection cells

Convection cells

Due to

Residual heat — Radioactive decay

Two main sources of heat within the Earth

- Decreasing order of Continents and Oceans

Area wise	Population basis
Asia	Asia
Africa	Africa
North America	Europe
South America	North America
Antarctica	South America
Europe	Australia
Australia	Antarctica

Mariana Trench deepest point: Challenger deep

deepest ocean

Oceans Order

P: Pacific Ocean

A: Atlantic Ocean (S-shape)

I: Indian Ocean

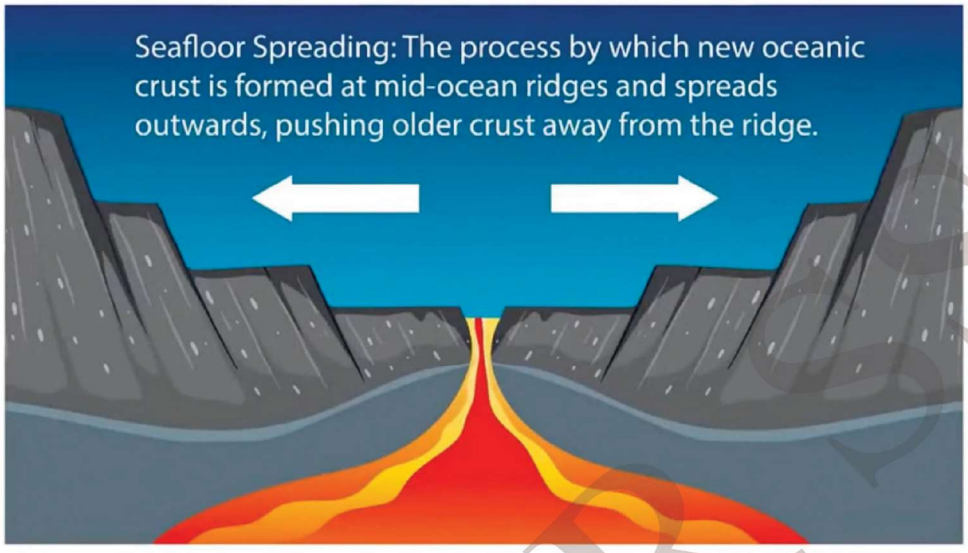
S: Southern (Atlantic)

A: Arctic

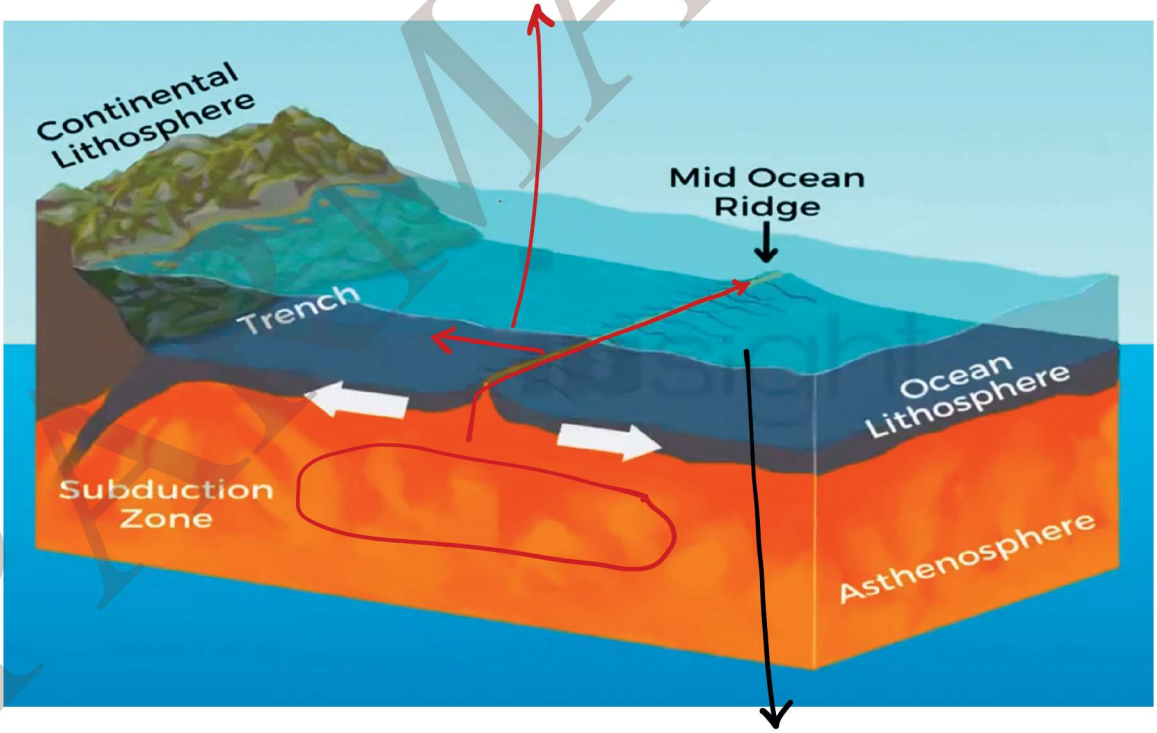
Busiest ocean

Sargasso Sea (brown algae Sargassum is seen here) - borderless sea

The Process of Seafloor Spreading



The age of oceanic rocks increases as you move away from the mid-ocean ridge



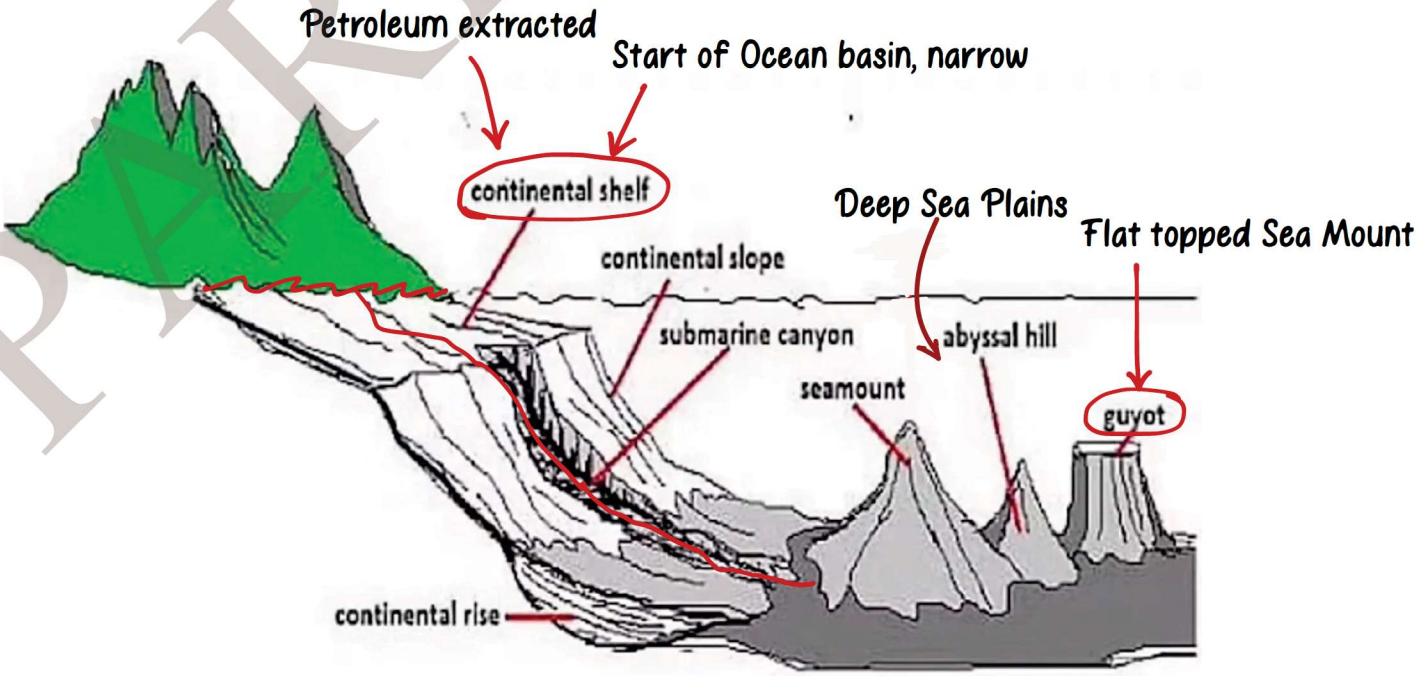
Oceans has more relief features than continents (more diversity)

- Harry H. Hess gave seafloor spreading theory, 1962

created due to divergent plate boundary

Mid-Atlantic Ridge

Longest and largest landform on Earth

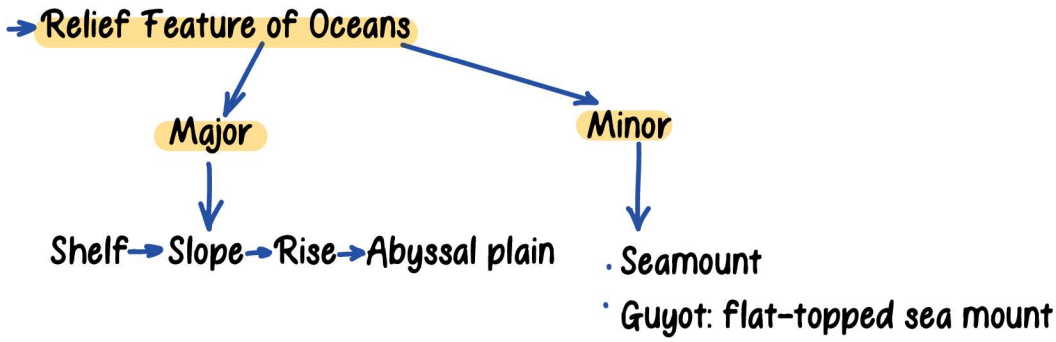


- Minor relief feature: Atoll, sea mount, guyot

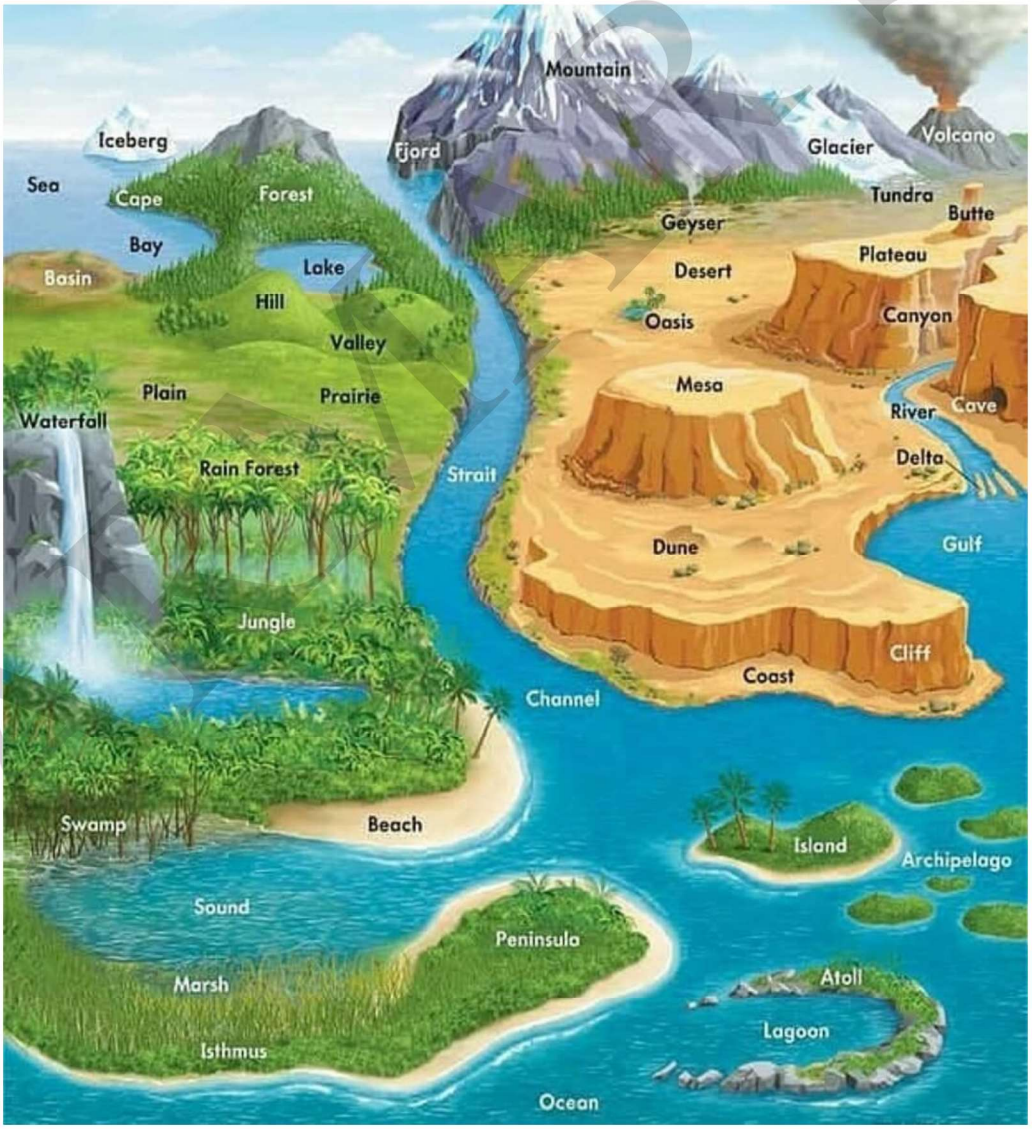
Corals: they are sea organisms, known as Rainforest of Sea

- Exists in symbiotic relationship with Zooxanthellae algae
  - Makes food for corals
  - Secretes $CaCO_3$ that provides protection to Zooxanthellae algae
- Corals exists in colony
- Favourable conditions:
  1. Saline water (cannot survive in fresh water)
  2. Sunlight
  3. Clear water
  4. Temperature: Moderate temperature 30–35°C
- Barrier Reef: Great Barrier Reef in Australia (largest)

- Coral bleaching: when water is too warm, corals will expel the algae (Zooxanthellae) living in their tissues causing the corals to turn completely white
  - due to climate change


Relief Feature of Oceans
Major
Minor
Shelf → Slope → Rise → Abyssal plain
Seamount
Guyot: flat-topped sea mount

GEOMORPHOLOGY AND LANDFORMS



Geomorphology

- Geomorphic process: Changes in the configuration of Earth
  - Land build/elevate → Endogenic forces
  - Erosion → Exogenic forces

- Example:
  Himalayas: continuously increasing → Endogenic > Exogenic
  Aravalis: continuously decreasing → Exogenic > Endogenic

- Endogenic forces: the pressure within the earth, also known as internal forces

  Energy from:
  - Radioactive decay
  - Tidal friction
  - Primordial heat

  *Convection current: Arthur Holmes

  Changes categorised into:

  1. Diastrophism: it is kind of process that move/elevate/build up the process of Earth

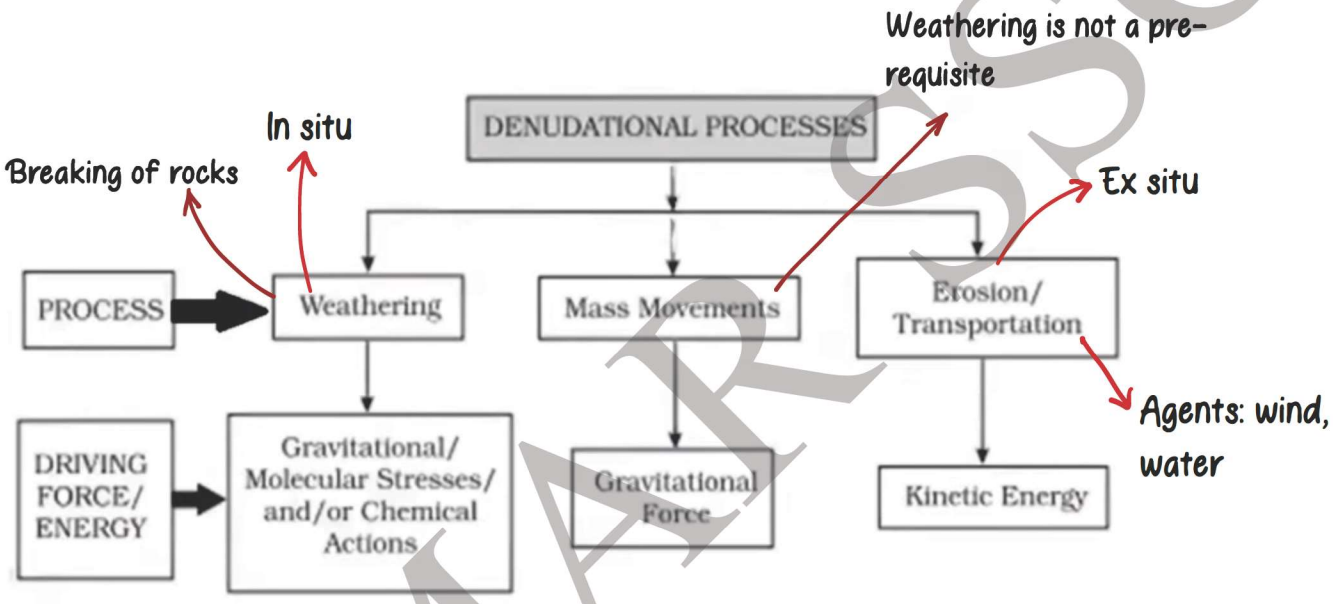
  Endogenic Processes:

  a. Orogenic: process through which mountains are built
  b. Epeirogenic: other changes except mountain build up
  c. Earthquake: shaking of Earth
  d. Plate tectonics

  2. Volcano: openings/vents where lava or magma erupts

- Exogenic Processes: due to Exogenic forces, causes wearing and tearing
  - Gradation: wearing down of relief features of Earth

- Collectively Exogenic forces are called Denudation
- Exogenic Agents: running water, wind, waves, ground water
- Ultimate sources of energy for all exogenic forces: Sun



- Weathering: Action of elements of weather and climate over Earth Materials
  It is a in situ process
- Types of weathering:
  1. Chemical weathering: the erosion or disintegration of rocks, building materials, etc. caused by chemical reactions
  2. Physical/Mechanical weathering: disintegration without chemical change
  3. Biological weathering: caused by movement of plants and animals

- Effect of Weathering:
- Exfoliation: process when large, curved plates or slabs of rocks are stripped away from the outer surface of a rock mass

Mass Movement

Fast Slow

- weathering is not a pre-requisite for Mass Movement, it aids the Mass Movement
- Main force involved: Gravity

Types:

- Landslide
- Avalanche
- Earthflow
- Mud flow

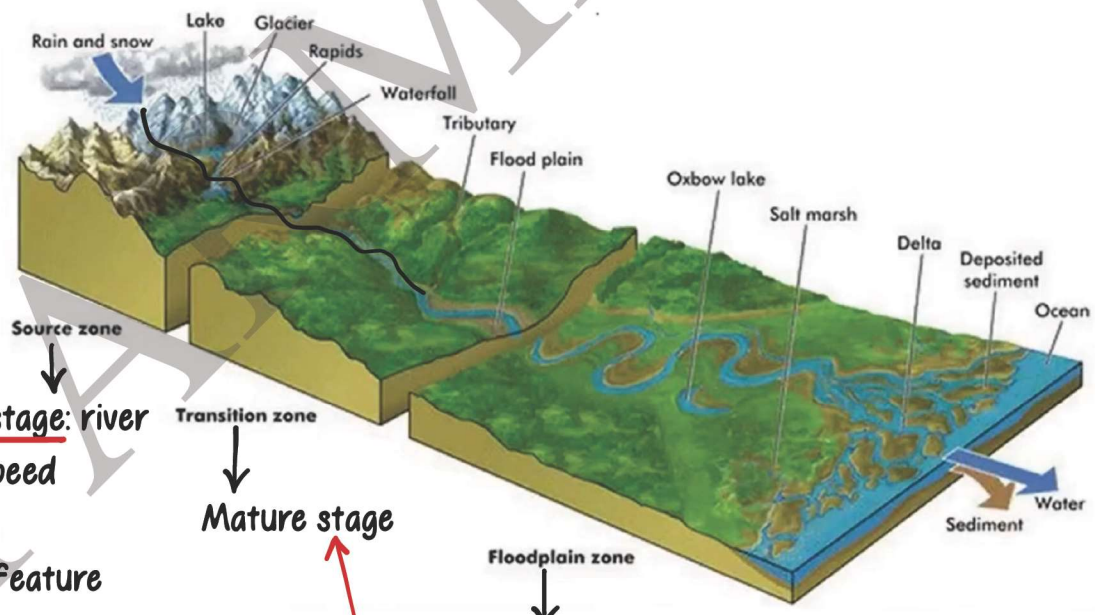
- Creep: slow downslope movement of particles
- Solifluction: slow progressive movement of mass down a slope

- Landforms

Types:

1. Erosional
2. Depositional

- Landforms Created by River



Youthful stage: river flows in speed

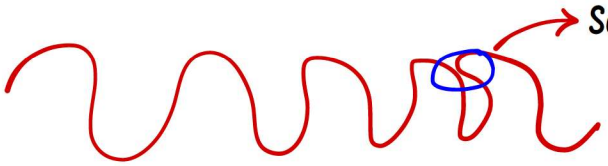
Erosional feature dominates

Mature stage

Old stage

Depositional feature dominates

- Youth stage: V-shaped valley, Gorges, Canyon, Waterfalls, Rapids, entrenched meander
- Mature stage: Meanders
- Old: ox-bow lake, delta, levees, flood plain

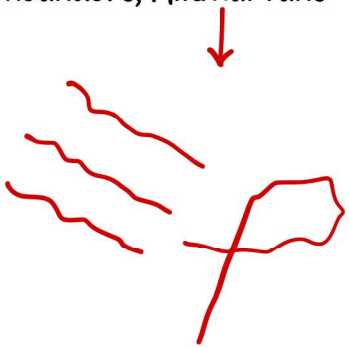


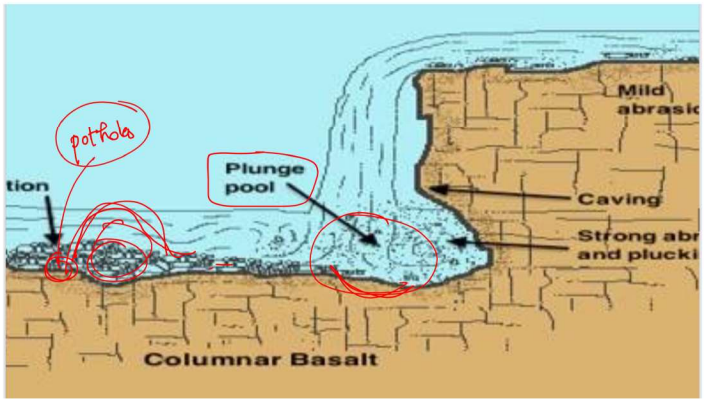
Erosional features:

- V-shaped valley, Gorges, Canyon, Waterfalls, Pothole, Plunge pools, River terraces

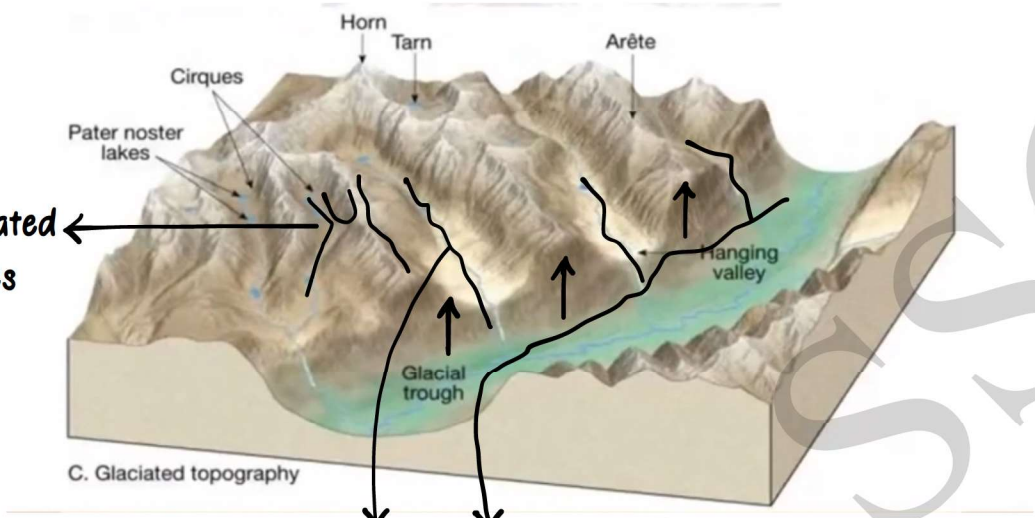
Incised Meanders: a meandering river valley that has cut down its bed into the bedrock because of uplift or lowered base level

- Depositional features: flood plains, Delta, ox bow lakes, meanders, Alluvial fans





Landforms Created by Glacier



Valley — Main valley created

*Fjord: Sea water entering into glacial valley

Erosional

- Cirque: are created in heads of glacial valleys
- Ridges/Arête
- Horn
- Hanging Valley
- Glacial Valley

Depositional

- Moraine
- Eskers
- Drumlins
- Outwash plains

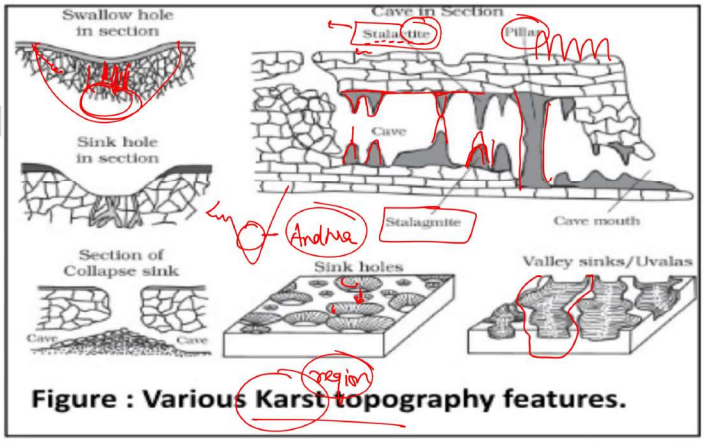


Figure : Various Karst topography features.

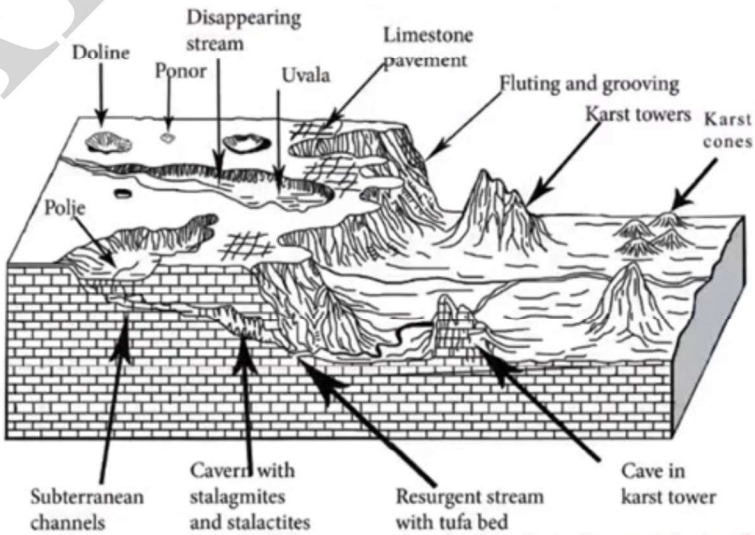
- **Landforms Created by Groundwater**: usually seen in places where rock is soft

Dolomite/Limestone

Chemical weathering

Dolines

Uvulas



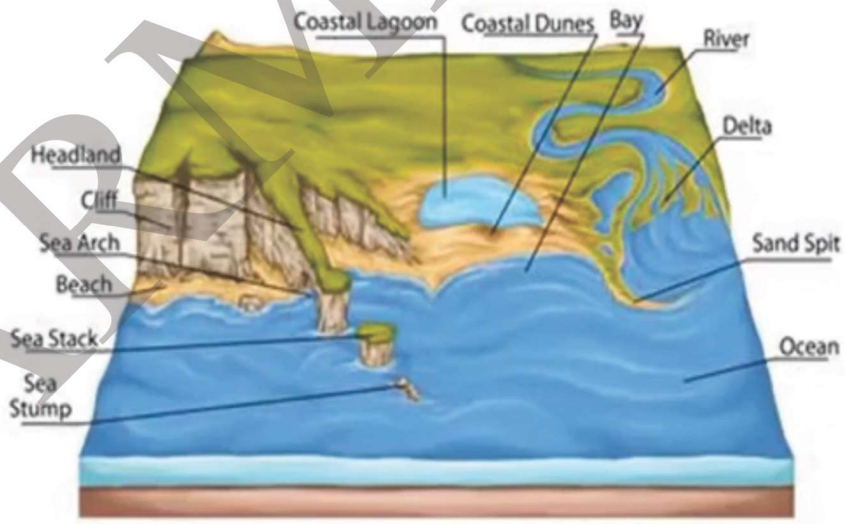
Karst Topography (in groundwater)

Found in Karst region in Mediterranean Sea where rocks are made of Limestone and Dolomite

In India, mainly in South India

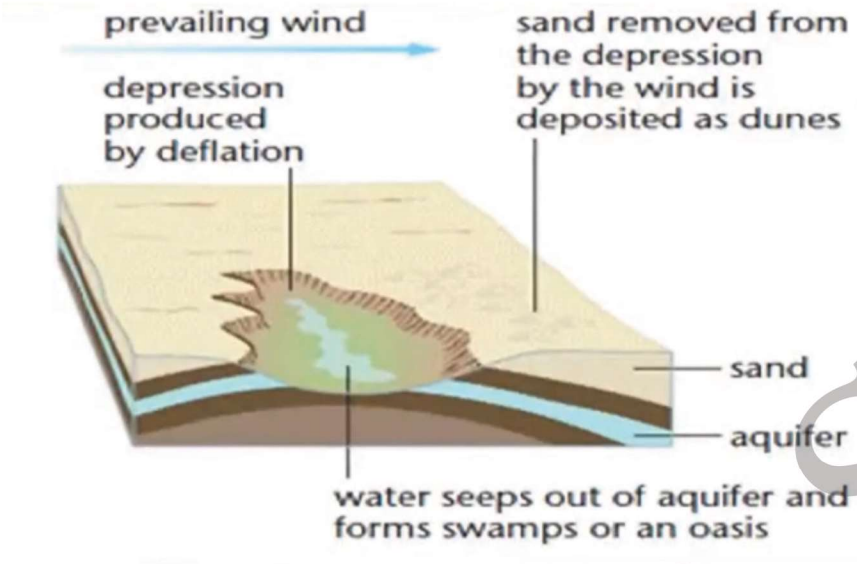
- Erosional: pools, sink holes, dolines, lapies, uvalas, limestones
- Depositional: Stalactite, Pillars, Stalagmite

- Landforms Created by Sea Waves



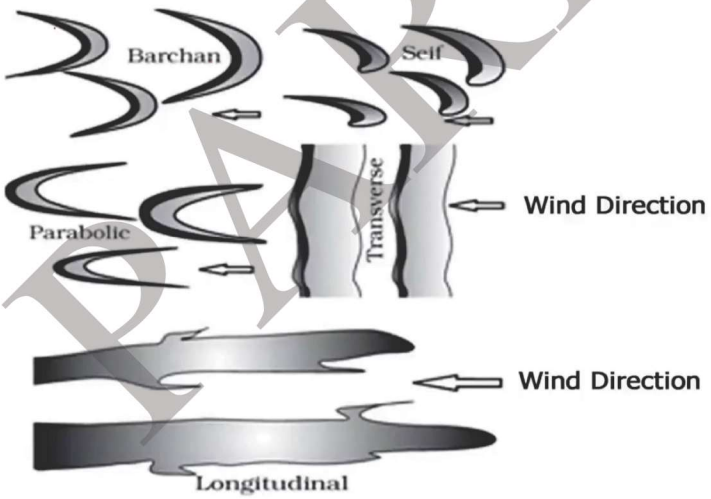
- Erosional: cliff, caves, stack, arch
- Depositional: beaches, dunes, bars, barrier, spits

- Landforms Created by Wind

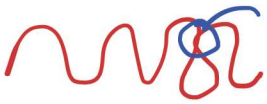


- Erosional: Pediplain, Playas, Mushroom rock, Pedestal rocks

- Depositional: Sand Dunes
  - Barchan
  - Seif



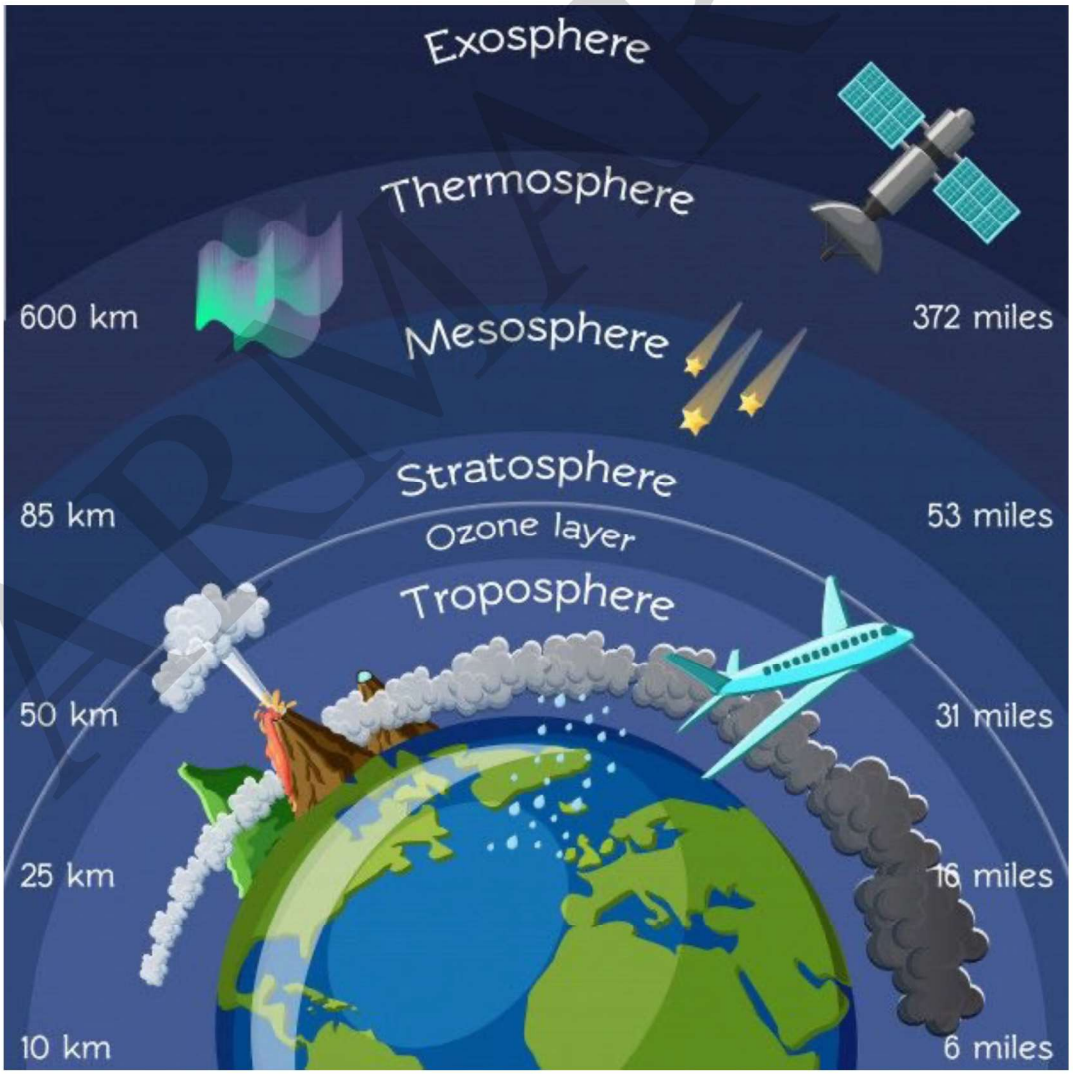
Mushroom Rock

1. Horn: Glacier
2. Lapie: sinkhole, pool, lapies, Dolines → Erosional landform by Groundwater
3. Ox-bow lakes:  River: old stage
4. Stack:  sea waves
5. Stalactite: groundwater

- Drumlins: glaciers
- Alluvial fan: river (youthful to mature stage)
- Barriers/Bar/Spit: sea waves
- Seif/Barchan : wind

- Only river that meanders in youthful stage: Jhelum

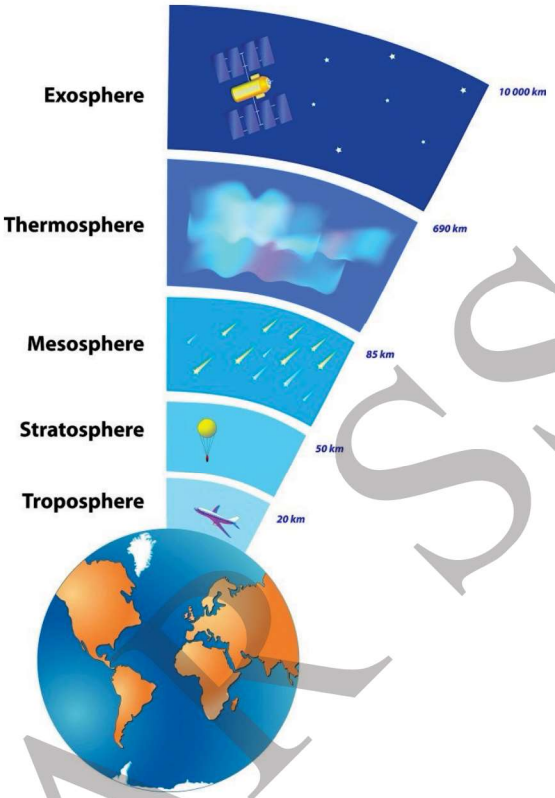
ATMOSPHERE AND WATER IN THE ATMOSPHERE



- Our atmosphere divided into certain layers

TRICK to remember layers

- Thank you: Troposphere
- So: Stratosphere
- Much: Mesosphere
- The: Thermosphere
- Ex: Exosphere



- Our atmosphere is a mixer of gases that surrounds Earth. It is kept in place by the pull of Earth's gravity

Evolution of Atmosphere

Stages:

1. Loss of primordial atmosphere- early atmosphere had more amount of H_2, He and due to excessive solar flares it vanished
2. Hot interior of Earth through volcanism
3. Modification by the living world (plants)

Troposphere

- Weather phenomenon
- Lowest layer of the atmosphere
- Height is variable:

Poles: 8 km
Equator: 18 km
> Average: 13 km

Tropopause: a line that separates Troposphere from Stratosphere

Composition of gases:

- N_2: 78%
- O_2: 21%
- Ar: 0.9% (second most abundant inert gas)
- CO_2: 0.036%
- He

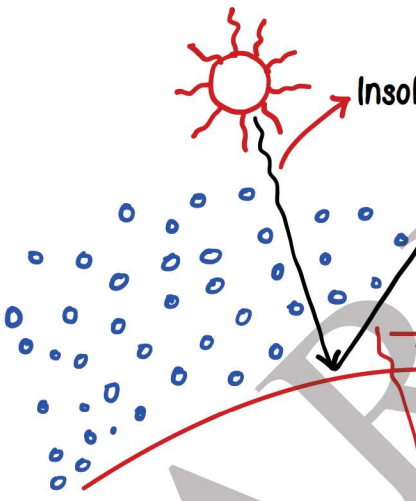
Troposphere generally decreases with altitude

this is called Lapse Rate

165 m 1°C

1 km 6.5°C

Why?



Insolation → Short wavelength (transparent)

heats the surface of Earth

terrestrial radiation → Heats the atmosphere

Long wavelength (opaque)

Greenhouse effect

Green House Gases:

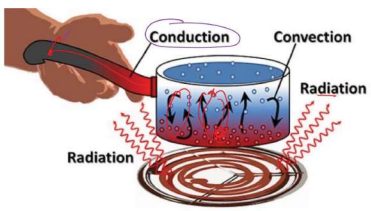
- Water vapour
- CO_2
- CH_4
- SO_2
- O_3 → Ozone

- NO_2 is not greenhouse gas

- Tropospheric Ozone is bad for our environment

Atmosphere heats up due to:

1. Conduction: layer that's near to Earth will heat through conduction (also vertical)
2. Convection: Vertically transfer of heat after conduction
3. Advection: Horizontal transfer of heat eg: loo is a result of advection



- Insolation

- Aphelion: the point when Earth is very far away from Sun (4th July)- Insolation less
- Perihelion: when Earth is closest to the Sun (3rd Jan)
  → Insolation is more

- Equator: Insolation is less here, due to presence of clouds
- Tropics: Insolation is high here as no good amount of clouds
  ↓
  max. at desert

Factors affecting Insolation:

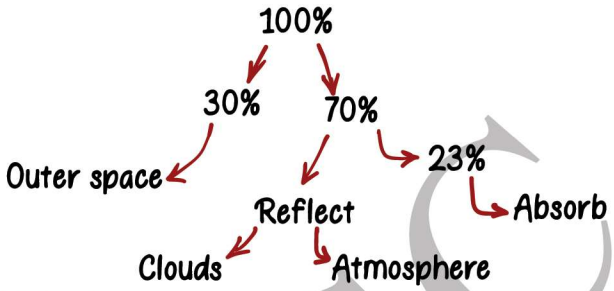
1. Transparency of atmosphere
2. Length of the day
3. Tilt of the Earth
4. Rotation
5. Position of Earth
6. Latitude
7. Altitude

- Albedo: the proportion of incident light or radiation that is reflected by a surface typically that of a planet or moon

Earth surface	(%)	Clouds	(%)
Asphalt		Shallow broken clouds	30
Oceans, lakes	8		
		Cu, Ci, Cs, Cc	35
Land surfaces	14-18	St	40
Sand, Desert	27	Thick clouds (Cs)	74
Ice and Snow		Ac, As, Sc	68
Sea ice →	35	Cu	75
Old Snow →	59	Ns	85
Fresh Snow →	80	Cb	90

Source: C.M. Kishtawal, 2004

- Heat Budget: When Earth's surface maintains its normal temperature, neither cools nor heat up



- * Albedo: percentage of light reflected by an object
  - Highest albedo: Ice caps/glaciers
- Temperature inversion: a layer in the atmosphere in which air temperature increases with height
- Conditions favourable:
  1. Long winter night
  2. Still air
  3. Clear cloudless sky

reaction is highly exothermic

Stratosphere

- Ozone layer is seen here: protects from harmful UV rays
- Ozone layer seen b/w 30–35 km
- Temperature increases with altitude/moving upwards
- Jet planes fly in this layer

- Ozone day: 16th Sept → 16 Sept 1987
  - Montreal, Canada → Montreal Protocol
    - Kigali Amendment made to phase out HFCs
    - Phase out CFCs (makes ozone layer thin) → Ozone hole
      - Ozone layer thickness measured by: Dobson unit

- Stratopause: divides stratosphere and mesosphere

Mesosphere

- Coldest layer atmosphere
- Meteorites end here
- Temperature decrease with altitude

Thermosphere

- Hottest layer
- Temperature increases with altitude
- Ions are seen here hence known as Ionosphere layer
  - ↓
  - Reflects radiowaves

- Karman line: boundary b/w the Earth's atmosphere and Exosphere
  - ↓
  - 100 km

- Isotherm: lines connecting the points having same temperature

- Water in the Atmosphere

97.2% → Saline water

2.8% → Fresh water

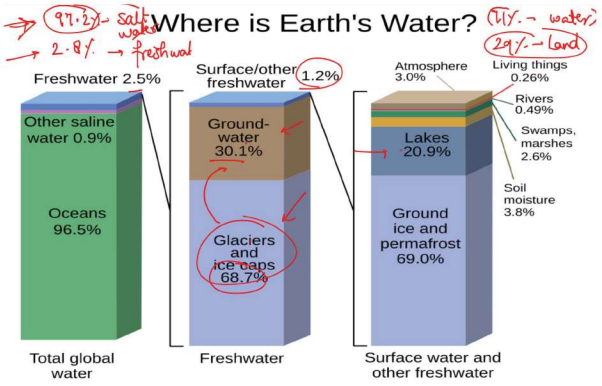
All out of 2.8%

- Ice caps/glaciers → 2%
- Ground water → 0.68%
- Lakes → 0.4%
- Atmosphere
- Rivers

order of freshwater

As a whole (Freshwater)

- Ice caps/glaciers: 68.7%
- Groundwater: 30.1%



Water Cycle

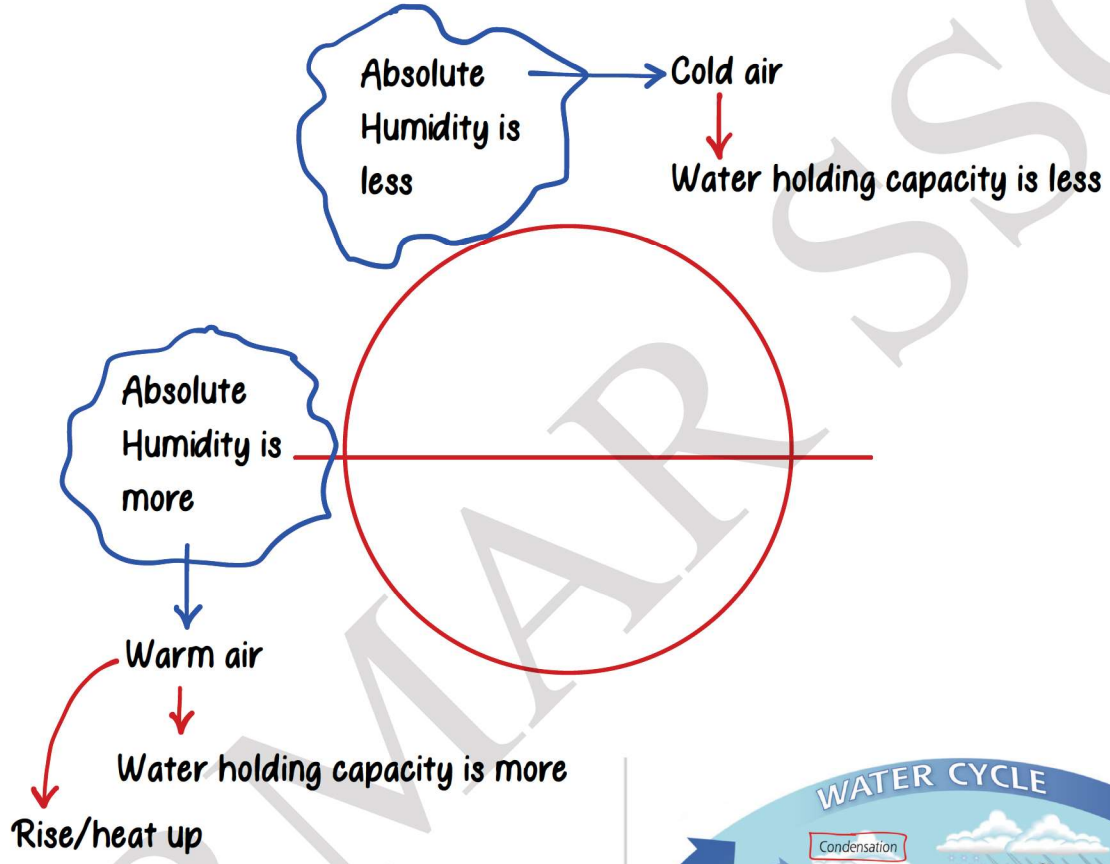
Processes:

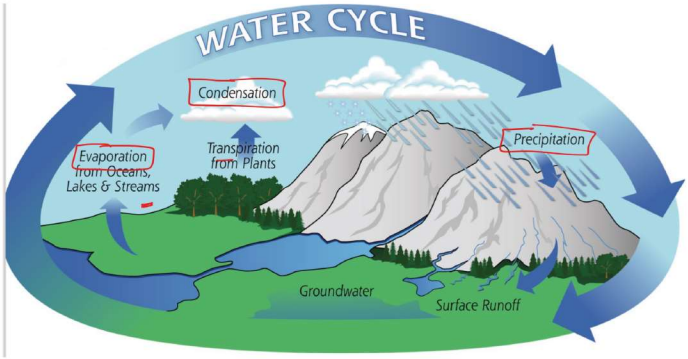
- Evaporation: water (liquid) → water vapour (gas)
- Condensation: water vapour → water
- Precipitation: rain, snow, hail → any kind of weather condition where something falling from sky

→ Precipitation: Release of moisture

- **Humidity**: water vapour present in atmosphere

- **Types**:
  1. **Absolute Humidity**: actual amount of water vapour present in atmosphere
  2. **Relative Humidity**: % of moisture present in atmosphere compared to its full capacity





- **Dew Point**: temperature at which saturation occurs

- **Condensation**

  Different forms:

  - Dew: moisture that forms as a result of condensation
  - Fog / Mist: no solid surface needed, water vapour condenses around hygroscopic particles

    कोहरा / कुहासा
  - Frost: deposition of white crystals
  - Clouds

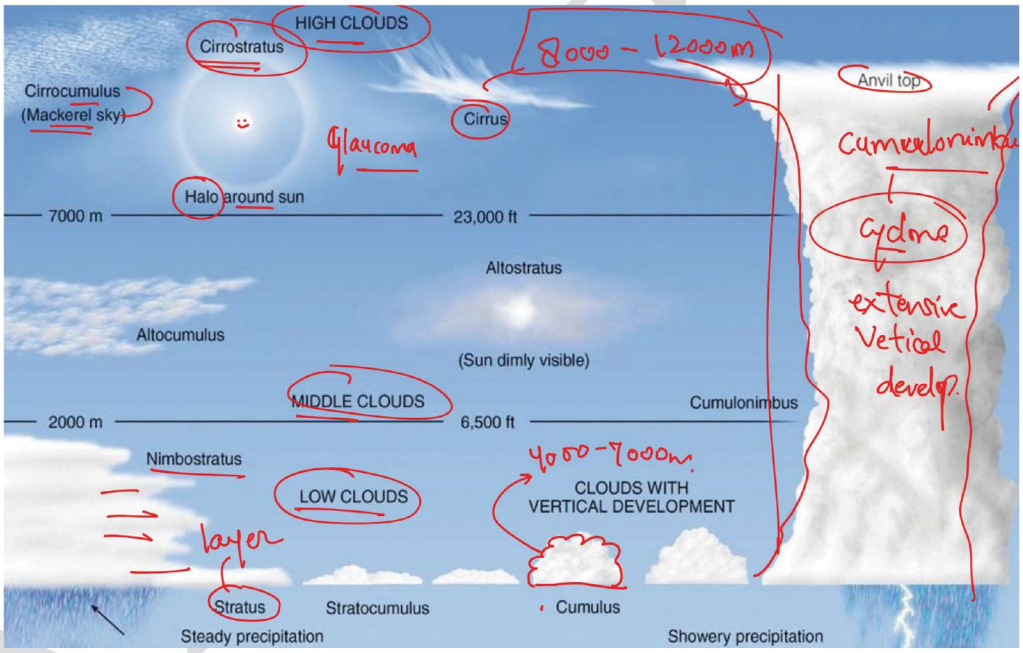
    → **Fog**: Big particles
    → **Mist**: Small particles

  - in winter air cools down due to which dew point reduces: water vapour → water

→ **Cloud seeding**: use of Silver Iodide (AgI)/Pot Iodide to help ice crystals form in suspended clouds, causing water droplets to freeze and fall less snow or rain

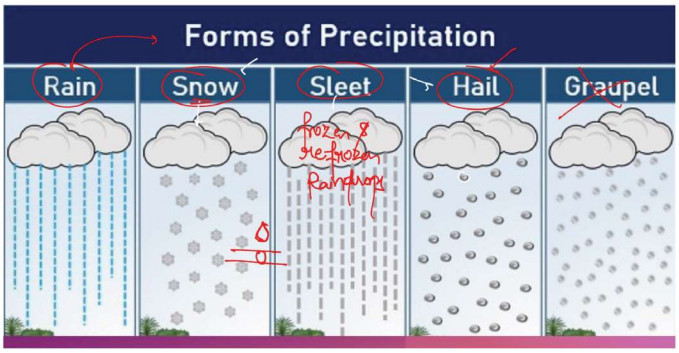
Different Types of Clouds

- **Low level clouds**
  - **Nimbus** → rain bearing; black/dark grey coloured; opaque to sunlight
  - **Stratus** → layered clouds
- **High level clouds**
  - **Cumulus** → Flat base, Wool shaped; does not rain; cotton wool; flat base; 4000–7000 m
  - **Cirrus** → High altitude; Feathery appearance; does not cause rain



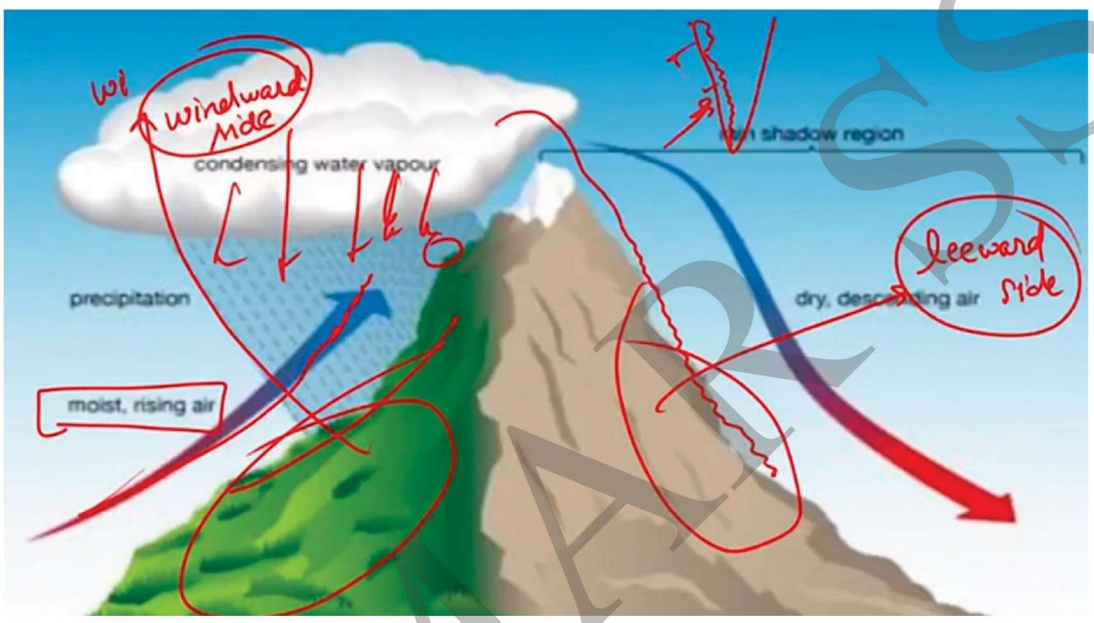
Types of Rainfall

- Rainfall is a precipitation
  - **Hail**
    - Size: big
  - **Sleet**
    - Frozen and refrozen drops
    - Size: small



3 types of rainfall:

1. **Convectional:** occurs when surface of the Earth is heated up by the Sun
2. **Orographic:** rainfall caused due to mountain
3. **Cyclonic:** due to cyclone



1. How much percentage of oxygen is present in the atmosphere?
(SSC CGL 02/12/2022 First Shift)
वायुमंडल में ऑक्सीजन का कितना प्रतिशत मौजूद है?

(a) 39%
(b) 79%
(c) 10%
(d) 21%

2. Which layer of atmosphere helps in radio transmission?
(SSC CGL 02/12/2022 Third Shift)
वायुमंडल की कौन सी परत रेडियो प्रसारण में सहायता करती है?

(a) Exosphere
(b) Thermosphere
(c) Mesosphere
(d) Stratosphere

a) बहिर्मंडल
b) बाह्य वायुमंडल
c) मीसोस्फीयर
d) स्ट्रैटोस्फियर

3. At what height do the Jet Streams blow in India during winter months? (SSC CPO 11/11/2022 Forth Shift)

सर्दियों के महीनों के दौरान भारत में जेट स्ट्रीम कितनी ऊँचाई पर बहती हैं?

(a) 9-15km
(b) 9-17km
(c) 9-16km
(d) 9-13km

4. Which of the following gases shields the surface of earth from ultraviolet (UV) radiation from the sun?
(SSC MTS 14/07/2022 Morning Shift)

निम्नलिखित में से कौन सी गैस पृथ्वी की सतह को सूर्य से पराबैंगनी (यूवी) विकिरण से बचाती है?

a) Carbon monoxide
b) Ozone
c) Oxygen
d) Carbon Dioxide

a) कार्बन मोनोआक्साइड
b) ओजोन
c) ऑक्सीजन
d) कार्बन डाईऑक्साइड

5. Which two gases are having the highest percentage of the earth's atmosphere?. (SSC CHSL 06/06/2022 Afternoon)

पृथ्वी के वायुमंडल में सर्वाधिक प्रतिशतता किन दो गैसों की है?

(a) Nitrogen and hydrogen
(b) Nitrogen and Oxygen
(c) Oxygen and Carbon Monoxide
(d) Carbon dioxide and nitrogen

a) नाइट्रोजन और हाइड्रोजन
b) नाइट्रोजन और ऑक्सीजन
c) ऑक्सीजन और कार्बन मोनोऑक्साइड
d) कार्बन डाइऑक्साइड और नाइट्रोजन

Poisonous gas

6. The ____ lies above the mesosphere and is a region in which temperature increases with height .
(SSC CGL 20/04/2022 Afternoon)

____मध्यमंडल के ऊपर स्थित है और यह एक ऐसा क्षेत्र है जिसमें ऊंचाई के साथ तापमान बढ़ता है।

(a) Stratosphere
(b) Exosphere
(c) Thermosphere
(d) Troposphere

a) स्ट्रैटोस्फियर
b) बहिर्मंडल
c) बाह्य वायुमंडल
d) क्षोभ मंडल

7. What is the approximate percentage contribution of argon in Earth's atmosphere? (SSC MTS 14/10/2021 Morning Shift)

पृथ्वी के वायुमंडल में आर्गन का लगभग प्रतिशत योगदान कितना है?

(a) 1%
(b) 2%
(c) 3%
(d) 4%

8. Which layer of atmosphere can experience the burning up of meteorites? (SSC MTS 27/10/2021 Evening)

वायुमंडल की कौन सी परत उल्कापिंडों के जलने का अनुभव कर सकती है?

(a) Mesosphere
(b) Exosphere
(c) Thermosphere
(d) stratosphere

a) मीसोस्फीयर
b) बहिर्मंडल
c) बाह्य वायुमंडल
d) समताप मंडल

9. Which of the following is NOT a greenhouse gas?. (SSC CGL 17/08/2021 Morning)

निम्नलिखित में से कौन सी ग्रीनहाउस गैस नहीं है?

(a) Helium
(b) Water vapour
(c) Surface-level ozone
(d) Nitrous oxide

a) हीलियम
b) जल वाष्प
c) सतह-स्तर-ओजोन
d) नाइट्रस ऑक्साइड

10. ____ is a naturally occurring phenomenon that is responsible for the heating of the Earth's surface and atmosphere. (SSC CPO 25/11/2020 Evening)

____ एक प्राकृतिक रूप से घटित होने वाली घटना है जो पृथ्वी की सतह और वायुमंडल के गर्म होने के लिए जिम्मेदार है

(a) Radiation
(b) Global warming
(c) Green house effect
(d) Global heating

a) विकिरण
b) ग्लोबल वार्मिंग
c) ग्रीनहाउस प्रभाव
d) वैश्विक तापन

11. The _____ layer is the upper limit of our atmosphere. It extends from the top of the atmosphere up to 10,000km (6200miles). (SSC CHSL 14/10/2020 Morning)

_____ परत हमारे वायुमंडल की ऊपरी सीमा है। यह वायुमंडल के शीर्ष से 10,000 किमी (6200 मील) तक फैला हुआ है।

(a) Ionosphere
(b) Exosphere
(c) Troposphere
(d) Mesosphere

a) योण क्षेत्र
b) बहिर्मंडल
c) क्षोभ मंडल
d) मीसोस्फीयर

12. Which is the second most abundant gas in Earth's atmosphere? (SSC CHSL 16/10/2020 Morning Shift)

पृथ्वी के वायुमंडल में दूसरी सबसे प्रचुर गैस कौन सी है?

(a) Oxygen
(b) Nitrogen
(c) Hydrogen
(d) Carbon monoxide

a) ऑक्सीजन
b) नाइट्रोजन
c) हाइड्रोजन
d) कार्बन मोनोआक्साइड

13. Which environmental phenomenon has been linked to synthetic chemicals like chlorofluorocarbons (CFC's)? (SSC CHSL 19/10/2020 Afternoon)

क्लोरोफ्लोरोकार्बन (सीएफसी) जैसे सिंथेटिक रसायनों से कौन सी पर्यावरणीय घटना जुड़ी हुई है?

(a) Electromagnetic interference
(b) Tidal Flow
(c) Ozone depletion
(d) Wave propagation

a) विद्युतचुंबकीय व्यवधान
b) ज्वारीय प्रवाह
c) ओज़ोन रिक्तीकरण
d) लहर प्रसार

14. Above which layer of the atmosphere does the exosphere lie? (SSC CHSL 19/10/2020 Afternoon)

बाह्यमंडल वायुमंडल की किस परत के ऊपर स्थित है?

(a) Stratosphere
(b) Thermosphere
(c) Mesosphere
(d) Troposphere

a) स्ट्रैटोस्फियर
b) बाह्य वायुमंडल
c) मीसोस्फीयर
d) क्षोभ मंडल

15. Which of the following is the lowermost layer of the atmosphere? (SSC CGL 09/03/2020 Afternoon)

निम्नलिखित में से कौन सा वायुमंडल की सबसे निचली परत है?

(a) Troposphere
(b) Thermosphere
(c) Exosphere
(d) Mesosphere

a) क्षोभ मंडल
b) बाह्य वायुमंडल
c) बहिर्मंडल
d) मीसोस्फीयर

16. Which of the following statements about the ionosphere is NOT correct? (SSC CPO 12/12/2019 Evening)

आयनमंडल के बारे में निम्नलिखित में से कौन सा कथन सही नहीं है?

(a) Radio wave transmitted from the earth are reflected back to the earth by this layer
(b) It contains charged particles
(c) It is ionized by solar and cosmic radiation
(d) It is located immediately above the stratopause.

a) पृथ्वी से प्रसारित रेडियो तरंगें इसी परत द्वारा वापस पृथ्वी पर परावर्तित होती हैं

17. A natural process of mechanical disintegration and or chemical decomposition of rocks of the crust of the Earth by certain physical and chemical agencies of the atmosphere is known as ? (SSC CGL 27/01/2023 First Shift)

वायुमंडल की कुछ भौतिक और रासायनिक एजेंसियों द्वारा पृथ्वी की परत की चट्टानों के यांत्रिक विघटन और या रासायनिक अपघटन की एक प्राकृतिक प्रक्रिया को क्या कहा जाता है?

(a) Mew rock formation
(b) Weathering
(c) Solidification of rock
(d) Watering of rock

a) म्याऊ चट्टान का निर्माण
b) अपक्षय
c) चट्टान का जमना
d) चट्टान को पानी देना

41. Nephology is the science of

नेफोलॉजी का विज्ञान है

(a) Wind
(b) Clouds
(c) Rain
(d) weather

a) हवा
b) बादलों
c) बारिश
d) मौसम

42. Clouds are formed by

बादलों का निर्माण होता है

(a) Condensation of water vapour in the atmosphere
(b) evaporation of water from the oceans
(c) Rising currents of the air
(d) Descending currents of the air

43. Which cycle shows the movement of water?
(SSC CHSL 02/06/2022 Afternoon)
कौन सा चक्र जल की गति को दर्शाता है?

(a) Carbon Cycle
(b) Nitrogen Cycle
(c) Geological Cycle
(d) Hydrological Cycle

a) कार्बन चक्र
b) नाइट्रोजन चक्र
c) भूवैज्ञानिक चक्र
d) जल विज्ञान चक्र

44. Clouds are basically made up of_____.
बादल मूल रूप से _____ से बने होते हैं।

(a) Droplets of water
(b) Dust
(c) Light
(d) White Colour

a) पानी की बूँदें
b) धूल
c) रोशनी
d) सफेद रंग

45. Humidity is measured by an instrument called
आर्द्रता किस उपकरण से मापी जाती है?

(a) Hygrometer
(b) Rain Gauge
(c) Nanometer
(d) Lactometer

a) आर्द्रतामापी
b) वर्षा नापने का यंत्र
c) नैनोमीटर
d) लाकटोमिटेर

milk purity

46. Which rainfall is caused by the lifting of an air mass because of the pressure difference?
दाब अंतर के कारण वायुराशि के ऊपर उठने से कौन सी वर्षा होती है?

(a) Orographic Rainfall
(b) Convectional Rainfall'
(c) Cyclonic Rainfall
(d) All of the above

a) औरोग्राफिक वर्षा
b) संवहनीय वर्षा'
c) चक्रवाती वर्षा
d) ऊपर के सभी

47. Which of the following are rain bearing cloud?
निम्नलिखित में से कौन वर्षा लाने वाले बादल हैं?

(a) Cumulus
(b) Alto
(c) Nimbus
(d) Stratus

a) क्यूम्यलस
b) अल्टो
c) चमक
d) फैला हुआ बादल

48. Which clouds are indicator of near future weather changes and are Often called Mares' tails?
कौन से बादल निकट भविष्य में मौसम परिवर्तन का सूचक होते हैं और जिन्हें अक्सर मार्स टेल कहा जाता है?

(a) Cirrus Clouds
(b) Cirrocumulus Clouds
(c) Cirrostratus Clouds
(d) None of the above

a) सिरस बादल
b) सिरोक्यूम्यलस बादल
c) सिरोस्ट्रेटस बादल
d) इनमे से कोई भी नहीं

49. Which clouds is also known as thanderstrom clouds?
किस बादल को थंडरस्ट्रॉम बादल के नाम से भी जाना जाता है?

(a) Cirrus Clouds
(b) Cumulus Clouds
(c) Cumulonimbus Clouds
(d) Cirrostratus Clouds

Cyclone

a) सिरस बादल
b) बहुत सारे बादल
c) क्यूम्यलोनिम्बस बादल
d) सिरोस्ट्रेटस बादल

50. The conversion of gaseous form of water into liquid form is known as?
जल के गैसीय रूप का द्रव रूप में परिवर्तन को क्या कहा जाता है?

(a) Condensation — a) वाष्पीकरण
(b) Solidification — b) जमाना
(c) Evaporation — c) वाष्पीकरण
(d) Deposition — d) निक्षेप

51. Precipitation take place in the form of?
वर्षा किस रूप में होती है?

(a) Solid — a) ठोस
(b) Liquid — b) तरल
(c) Solid and also in liquid — c) ठोस भी और तरल भी
(d) None of the above — d) इनमे से कोई भी नहीं

52. Moisture is deposited in the form of water droplets on cooler surfaces of solid objects is known as?
नमी पानी के रूप में जमा होती है
ठोस वस्तुओं की ठंडी सतहों पर बूंदों को क्या कहा जाता है?

(a) Frost — a) ठंढ
(b) Dew — b) ओस
(c) Smog — c) धुंध
(d) Fog — d) कोहरा

Hygroscopic particle released from vehicles as pollution particles

Visibility is low

53. Which refers to the amount of water vapour present in the air?
जो जलवाष्प की मात्रा को दर्शाता है
हवा में मौजूद?

(a) Smog — a) धुंध
(b) Humidity — b) नमी
(c) Fog — c) कोहरा
(d) Frost — d) ठंढ

54. The two ingredients needed to form clouds aloft are
ऊपर बादलों को बनाने के लिए आवश्यक दो सामग्रियां हैं

(a) Instability and lifting — a) अस्थिरता और उठाव
(b) Lifting and saturated air — b) उठाने और संतृप्त हवा
(c) Wind shear and lifting — c) पवन कतरनी और उठाना
(d) Air with high dewpoint and instability — d) उच्च ओसांक और अस्थिरता वाली वायु

55. A visibility of less than 1 km is the internationally recognized definition of?
अंतरराष्ट्रीय स्तर पर दृश्यता 1 किमी से भी कम है
की मान्यता प्राप्त परिभाषा?

(a) Haze — a) धुंध
(b) Fog — b) कोहरा
(c) Frost — c) ठंढ
(d) Smog — d) धुंध

56. Clouds burst is associated with?

बादल फटना किससे सम्बंधित है?

(a) Altostratus
(b) Cumulonimbus
(c) Cirrocumulus
(d) None of these

a) आल्टोस्ट्रेटस
b) क्यूम्यलोनिम्बस
c) पक्षाभ कपासी बादल
d) इनमें से कोई नहीं

57. Where is Orographic rainfall found in India?

भारत में पर्वतीय वर्षा कहाँ पाई जाती है?

(a) Eastern ghats
(b) Western ghats
(c) Malwa Palateua
(d) Northern eastern States

a) पूर्वी घाट
b) पश्चिमी घाट
c) मालवा पलटुआ
d) उत्तरी पूर्वी राज्य

58. The Cirrus and Cumulus are types of _____.
(SSC CHSL 19/10/2020 Morning)

सिरस और क्यूम्यलस _____ के प्रकार हैं।

(a) Mountains
(b) Waves
(c) Clouds
(d) Soil

a) पहाड़ों
b) लहर की
c) बादलों
d) मिट्टी

60. The capacity of an air of certain volume at certain temperature to retain maximum amount of moisture content is known as

किसी निश्चित तापमान पर निश्चित आयतन वाली वायु की अधिकतम मात्रा में नमी बनाए रखने की क्षमता को क्या कहा जाता है?

(a) Relative humidity
(b) Specific humidity
(c) Absolute humidity
(d) Humidity capacity

a) सापेक्षिक आर्द्रता
b) विशिष्ट आर्द्रता
c) पूर्ण आर्द्रता
d) आर्द्रता क्षमता

61. Which term is used to express the ratio of weight of water vapour to the total weight of moist air ?

जलवाष्प के भार और नम वायु के कुल भार के अनुपात को व्यक्त करने के लिए किस शब्द का प्रयोग किया जाता है?

(a) Relative humidity
(b) Absolute humidity
(c) Specific humidity
(d) None of the above

a) सापेक्षिक आर्द्रता
b) पूर्ण आर्द्रता
c) विशिष्ट आर्द्रता
d) इनमे से कोई भी नहीं

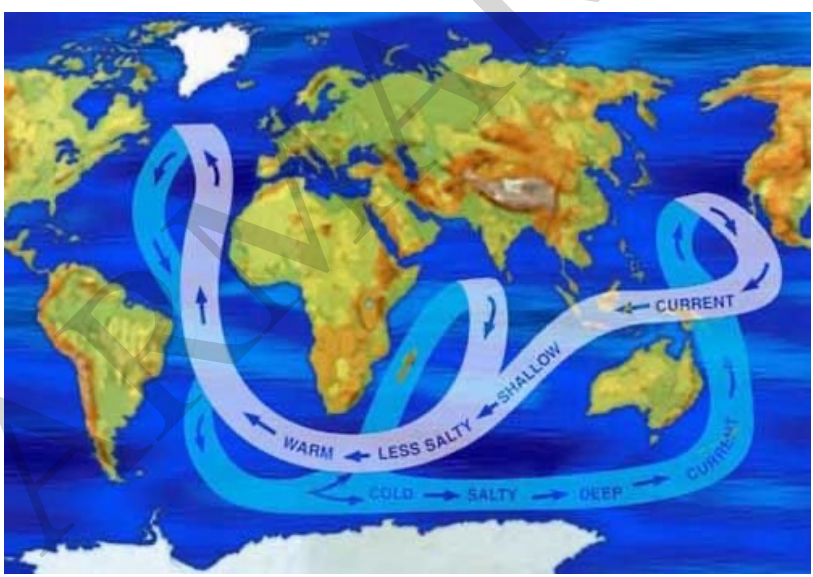
64. Mawsynram in the southern ranges of the ____receives the highest average rainfall in the world? (SSC CGL 17/07/2023 Third Shift)

की दक्षिणी श्रृंखला में मासिनराम में दुनिया में सबसे अधिक औसत वर्षा होती है?

(a) Aravali
(b) Shivalik
(c) Nilgiri
(d) Khasi Hills

a) अरावली
b) शिवालिक
c) नीलगिरि
d) खासी पहाड़ियाँ

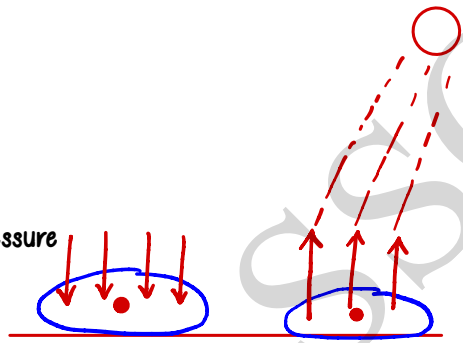
WINDS, CLIMATE, OCEAN CURRENTS

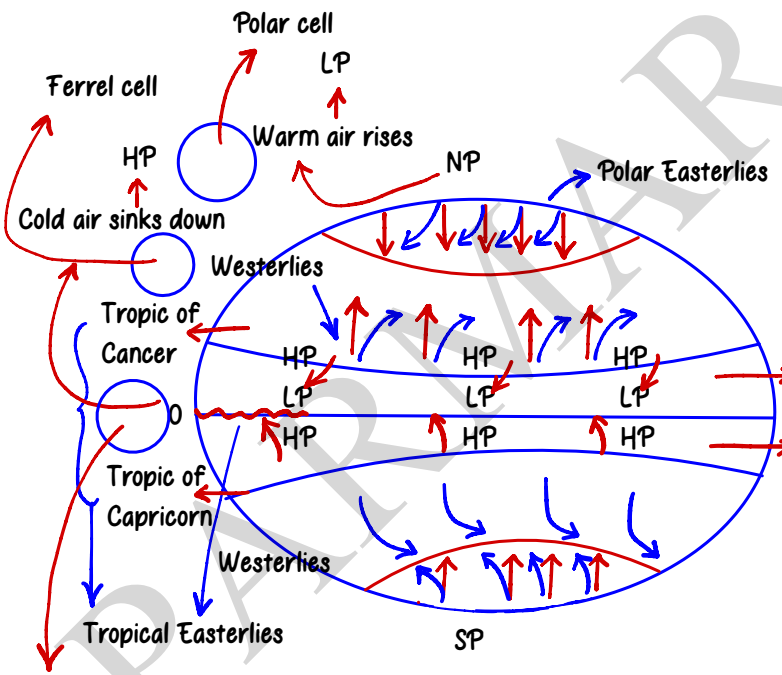


- Pressure difference causes wind because
  Warm air → Rises → Low pressure
  Cold air → Sink → High pressure

- Wind: High pressure → Low pressure

Type of winds
- Trade winds
- Local winds





- Forces: Coriolis Force
  - Due to rotation
    - NH → Right
    - SH → Left

North East Easterlies

South East Easterlies

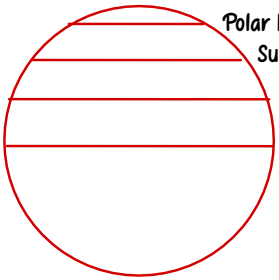
- Wind name: Due to direction of origin

Meeting point of these two zones is known as ITCZ Zone (Inter Tropical Convergence Zone) (NE + SE)

Shifts upward to Tropic of Cancer in summer and shifts to Tropic of Capricorn during winter

Doldrum Zone is seen here

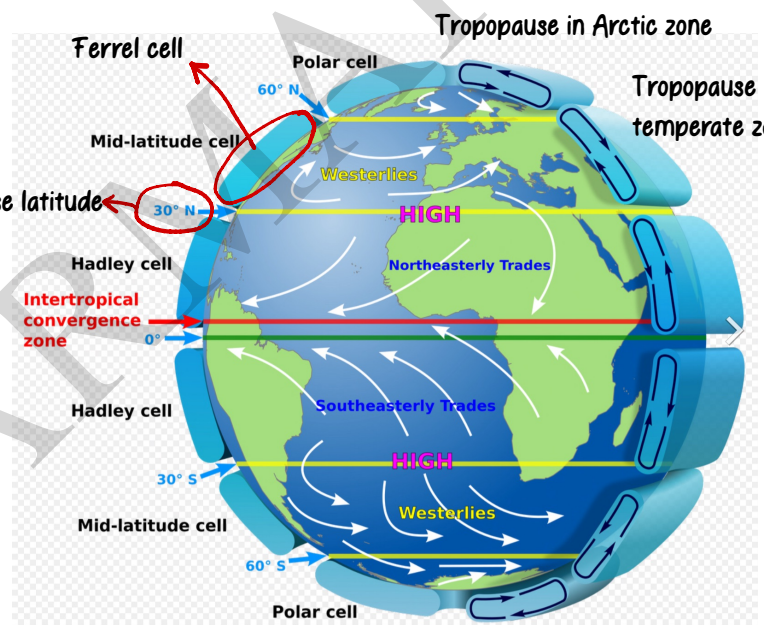
Here:
- Coriolis force is zero
- Winds relatively calm

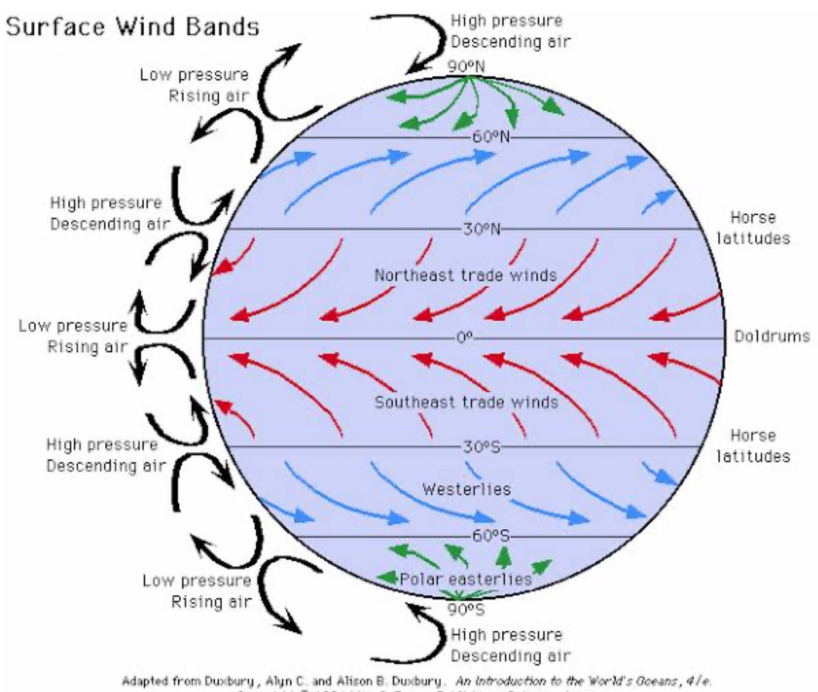


Trade winds: Permanent winds

- Easterlies (East direction)
  - Tropical
  - Polar
- Westerlies (West direction)

- Horse latitude: seen in 30°N/30°S
- Coriolis force → Max at poles
  - Zero at equator
- when at higher latitude, wind rotates a lot and blows parallel to isobar



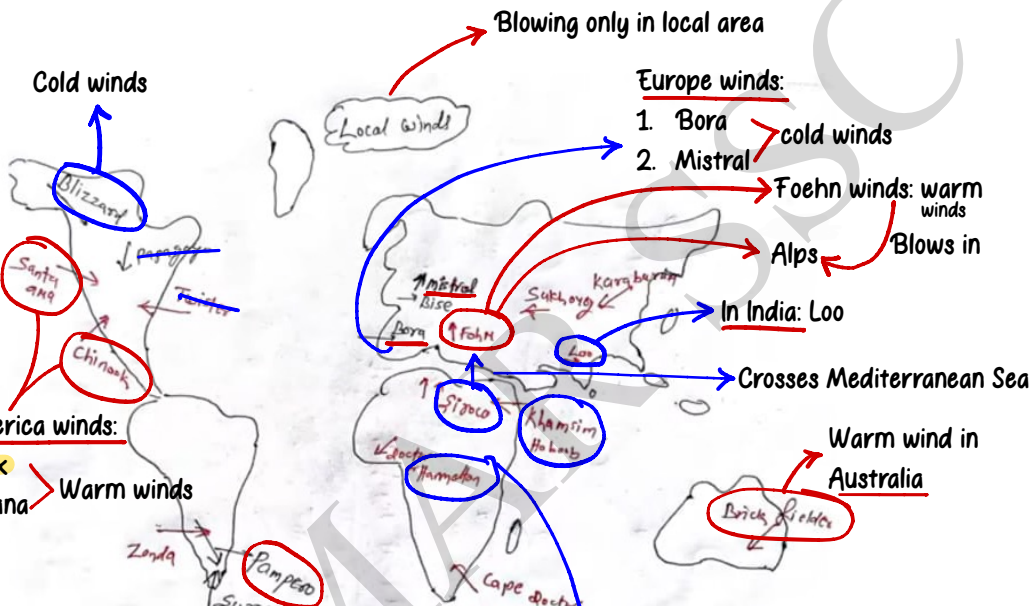


Adapted from Duxbury, Alyn C. and Alison B. Duxbury. *An Introduction to the World's Oceans, 4/e.*

LOCAL WINDS


Snow eater
Warm
Chinook
Nor'easter
Blizzards
Norther
Norte
NORTH AMERICA
Cold
Helm
Warm
Mistral
Bora
Levant
Fohn
Etesians
EUROPE
Alp
Sirocco
Khamsin
Egypt
Harmattan
Blood rain
Haboob
(Non-Directional)
Dr wind
Guinea
Berg
Buran
Karaburan
ASIA
SOUTH AMERICA
Pampero
Argentina
AFRICA
Bricklfielder
Southerly
AUSTRALIA

- **Geostrophic winds**: winds that blow parallel to isobars
- **Isobars**: line connecting the points having same pressure

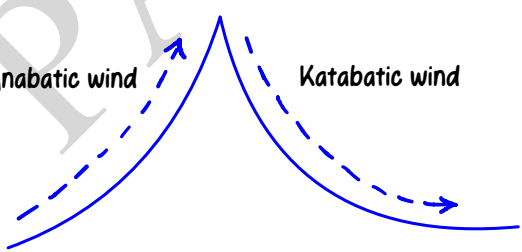


Local winds

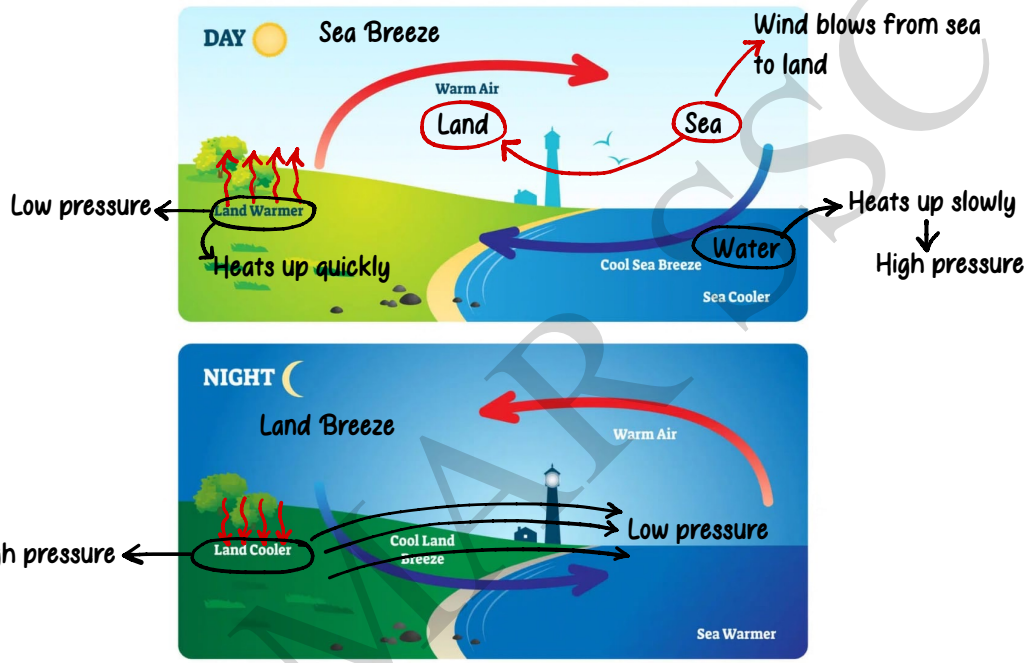
Warm winds | Cold winds

Wind

Anabatic wind | Katabatic wind



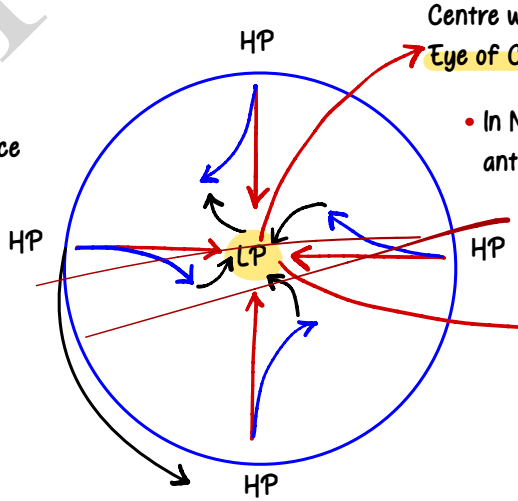
LAND VS SEA BREEZE



- Land: heats up and cools down quickly
- Water: heats up and cool down slowly

Cyclones

- At Equator, the Coriolis force is zero → No cyclone



Centre where wind meet is called Eye of Cyclone

- In NH, the wind will rotate anticlockwise

no clouds, calm area, no rainfall

Conditions favourable:

1. Large Sea Surface temperature
2. Coriolis force
3. Small variation in vertical wind speed
4. Pre-existing weak LP area

- During cyclone, Cumulonimbus clouds are formed → Causes heavy rain and thunderstorms

Cyclone at High Latitudes are caused due to Frontogenesis

↓

Fronts

↓

Two different air masses are formed/meet

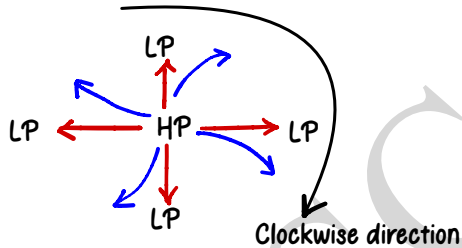
↓

Causes Extratropical/Temperate Cyclone

- Difference in Tropical and Temperate cyclone

Tropical	Temperate
• Only in Sea	• In land/sea
• More destructible	• Less destructible
• Not frequent	• More frequent
• Flows East to West	• Flows from West to East

Anticyclone: forms around high pressure



	Cyclone	Anticlockwise
NH →	Anticlockwise	Clockwise
SH →	Clockwise	Anticlockwise

Different names of cyclones:

1. Atlantic Ocean: Hurricane
2. Australia: Willy-Willy
3. Western Pacific/South China Sea: Typhoon
4. Indian Ocean: Cyclone

Koeppen Climatic Classification

- Weather: short term
- Climate: long term → Roughly 30 years data is taken

Koeppen in 1884 → Empirical Climatic Classification

- Used capital and small letters
- Climatic groups represented with different codes

A B C D E

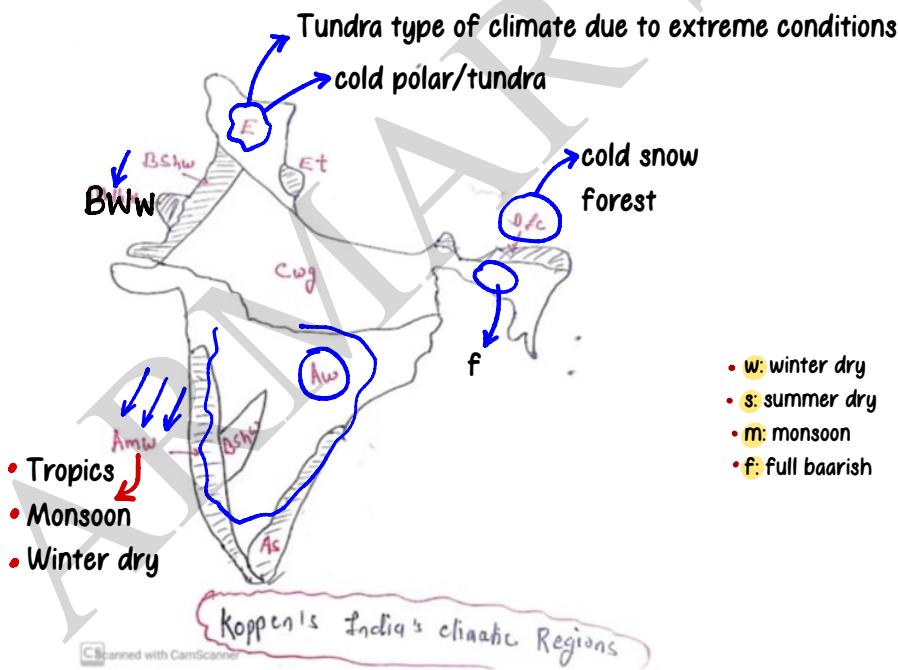
5 major climatic groups

On precipitation basis

- Mediterranean Sea: Cs

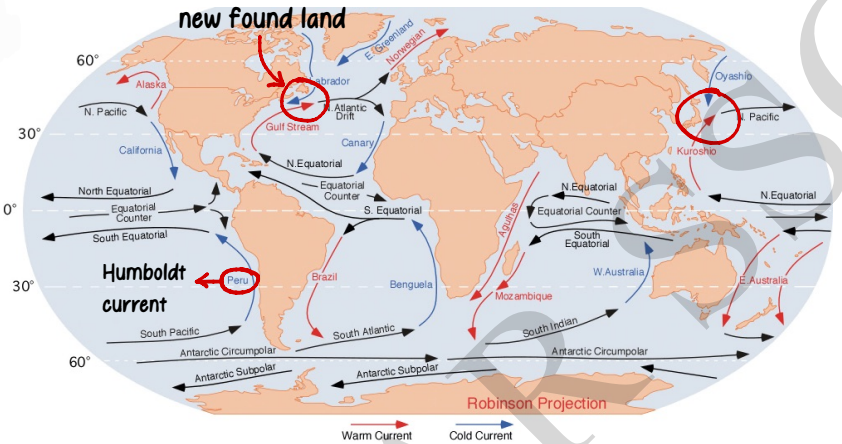
Koeppen's Classification

- **A: Tropical** → Average temperature of coldest month: 18°C or higher
- **B: Dry Climate** → Potential evaporation exceeds precipitation
  - **S** → Steppe
  - **W** → Desert
- **C: Warm Temperate** → Average temperature of coldest month of climate years is higher than −3°C but below 18°C
- **D: Cold Snow Forest** → Average temperature of coldest month is −3°C or below
- **E: Polar type (cold)** → Average temperature for all months is below 10°C



- w: winter dry
- s: summer dry
- m: monsoon
- f: full baarish

Ocean Currents



TRICK

B → Benguela
P → Peru
company
G → Greenland
O → Oyashio
L → Labrador
F → Falkland
W → West Australian Drift
C → Canary
California → California

Cold Ocean Current

Reasons of origination:

1. Heating by Sun
2. Wind
3. Density different
4. Coriolis force
5. Coastline of continents

- Cold air: water holding capacity less
- Warm air: water holding capacity high

Types of Ocean Currents

- Surface: 10%
- Deep Sea: 90%

Cold water moves from poles to equator
Warm water moves from equator to poles

Effects:

1. Warm ocean current + cold ocean current → Best fishing zones

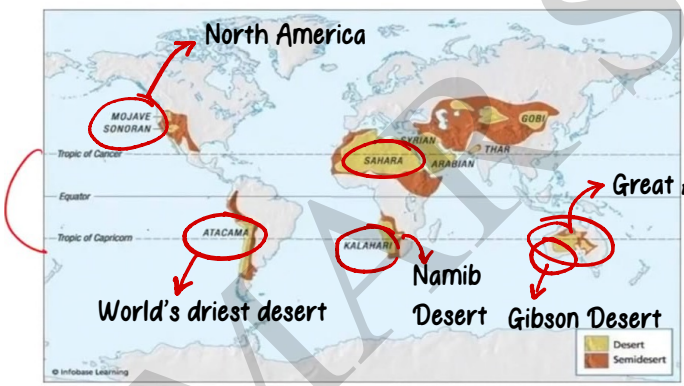
↓

Creates foggy conditions: worst for Harbouring

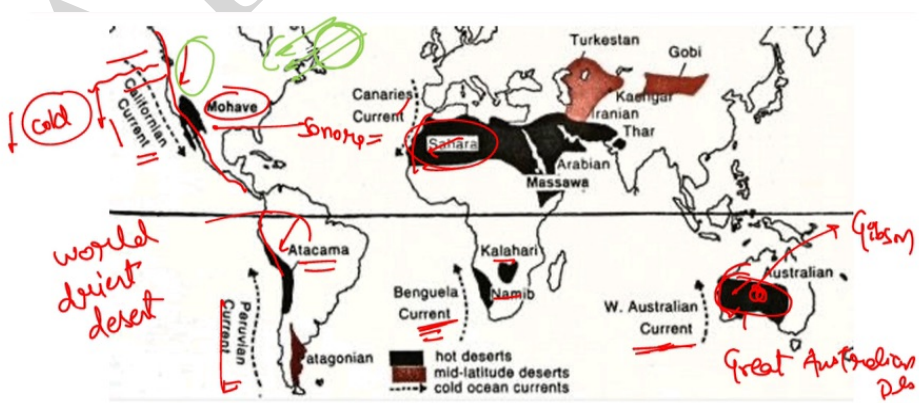
2. Cold ocean current: creates desert

↓

Max. desert seen on Western side of the continent



- Grasslands: areas where there is not much precipitation (Rainfall)



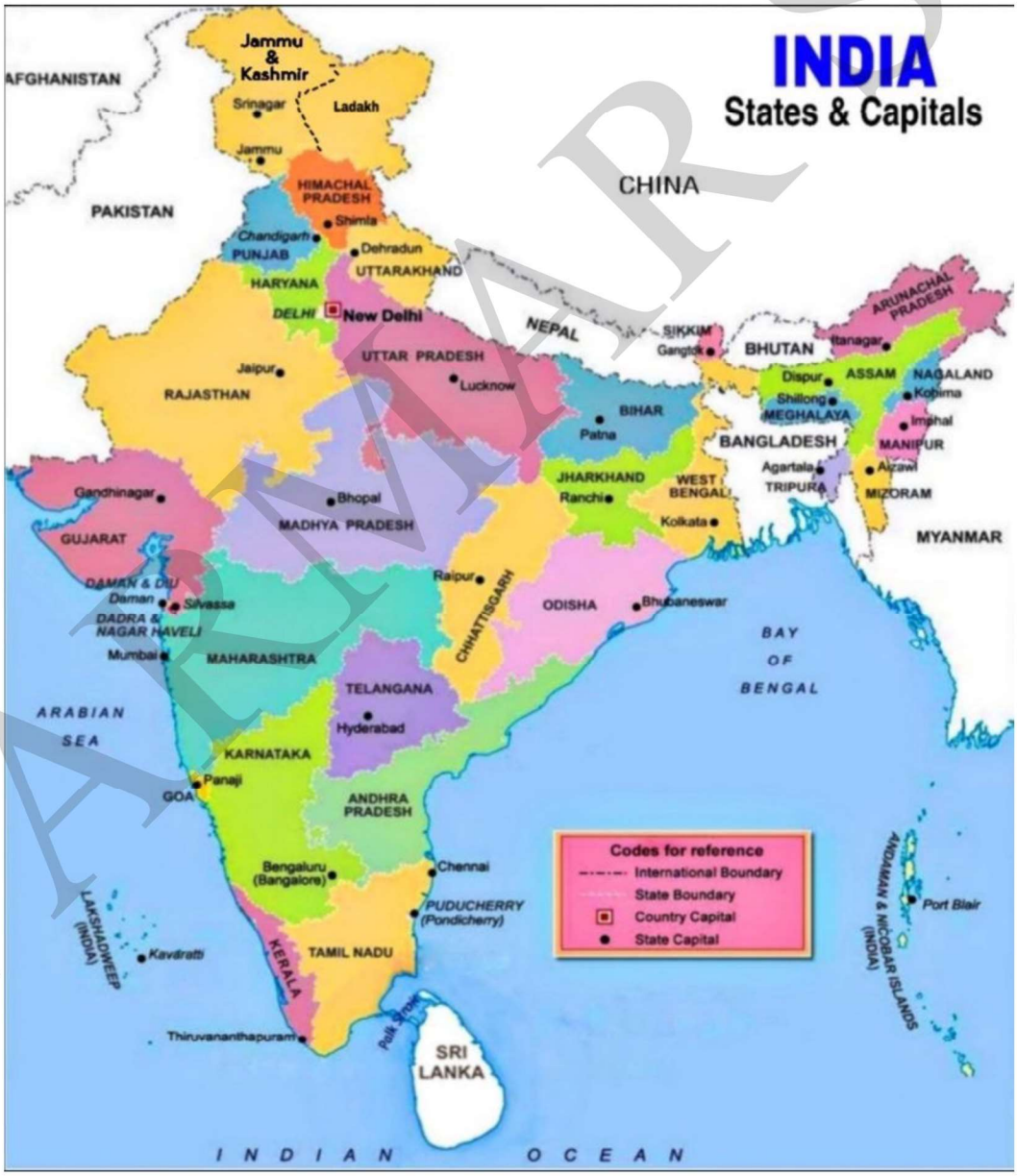
Water vapour: it is a gas, the amount of which decreases with altitude

Products of volcanic eruptions:
Pyroclastic debris
Ash and dust
Nitrogen compounds
Sulphur compounds

On June 21, every year, Tropic of Cancer and Arctic Circle experiences a sunlight of more than 12 hours

Coriolis force increases with increase in wind velocity, and it is maximum at poles and is absent at the equator

INDIA AND IT'S BOUNDARY



	State	UT
Largest	UP	Delhi
Smallest	Sikkim	Lakshadweep

Population wise

- India was a part of Gondwanaland

- India in terms of area is in the 7th position
- 1st: Russia
- 2nd: Canada
- 3rd: China
- 4th: USA
- 5th: Brazil
- 6th: Australia
- 8th: Argentina

	State	UT
Largest	Rajasthan	Ladakh
Smallest	Goa	Lakshadweep

Time Zones
- Russia: 11
- USA: 4
- Max. in France: 12 (because of many territories)

- Smallest: Vatican City

- India occupies 2.4% of total world's land area

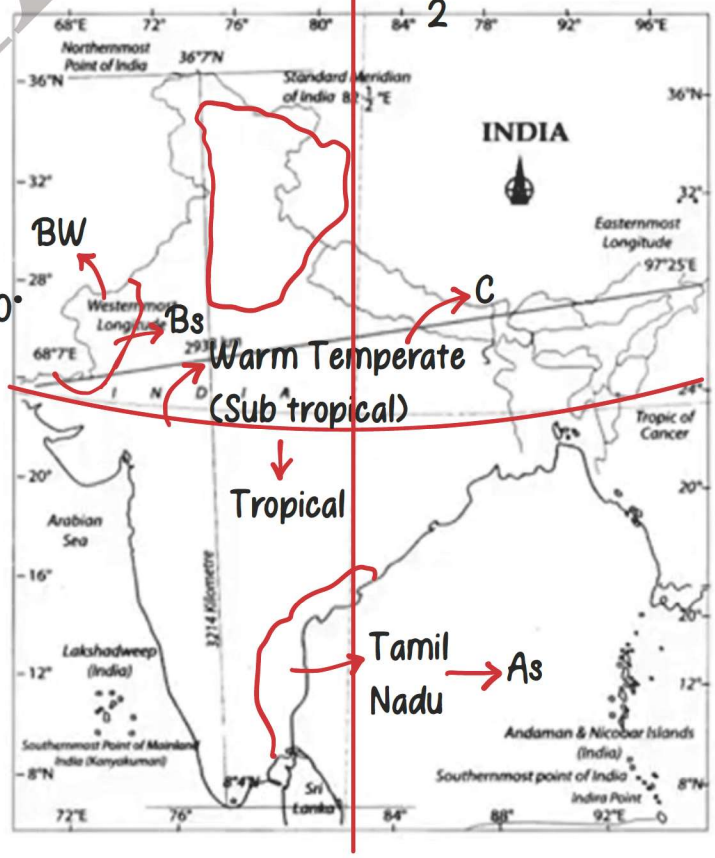
- Population is 17.78% of world's total population
  - 1st rank: 1.21 Bn

- India has total state: 28
- Total UTs: 8
- North-South extent: 3214 km
- West-East: 2933 km
- Latitudinal extent: 8°4'-37°6' → Difference: ~30°
- Longitudinal extent: 68°7'-97°25' → Difference: ~30°

- Difference b/w every latitude is same: 111 km
- Difference b/w every longitude is varying
  - Max. at the equator
  - Zero at the poles

India's common time zone

$82\frac{1}{2}°E$



Time difference between Gujarat and Arunachal: 30°

= 30 x 4

= 120 mins = 2 hrs

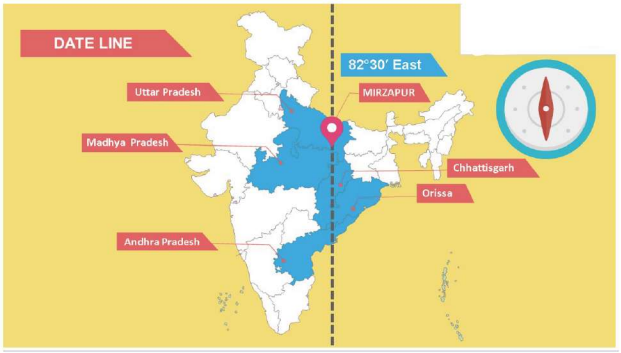
1° = 4 mins

15° = 1 hr

Extremes	State	Point
Northernmost:	Himachal Pradesh	Indira Col
Southernmost:	Tamil Nadu	Kanyakumari/Cape Camorin/ Indira Point
Easternmost:	Arunachal Pradesh	Kibithu
Westernmost:	Gujarat	Guhar Moti/Sir Creek

- 15° = 1 hr
- 7.5°= 30 mins
- Total time: 24 hrs
- Indian Standard Time (IST): 82.5° E
- IST passes through: 5 states

M: Madhya Pradesh
O: Odisha
U: Uttar Pradesh (Naini, Mirzapur)
C: Chattisgarh
A: Andhra Pradesh



Indian Standard Time

- India's important latitude: Tropic of Cancer → 23 1/2° N

Pass through 8 states

TRICK

Gujarati → Gujarat
Raja → Rajasthan
Made → Madhya Pradesh
Chief → Chattisgarh
Justice → Jharkhand
Win → West Bengal
The → Tripura
Meeting → Mizoram


Names of International Border Lines of India
AFGHANISTAN
PAKISTAN
LOC
LAC
CHINA (Tibet)
NEPAL
BHUTAN
BANGLADESH
INDIA
MYANMAR (BURMA)
Arabian Sea
Bay of Bengal
Lakshadweep (India)
Andaman & Nicobar Islands (India)
SRI LANKA
Neighbouring Countries of India
International Boundary
Radcliffe Line
McMahon Line
Durand Line
Line of Control (LOC)*
Line of Actual Control (LAC)*
*LOC & LAC are not recognised as international boundary, as by virtue of Instrument of Accession, entire state of Jammu and Kashmir legally and constitutionally

- How many capital cities of these 8 States are above (in North) Tropic of Cancer?

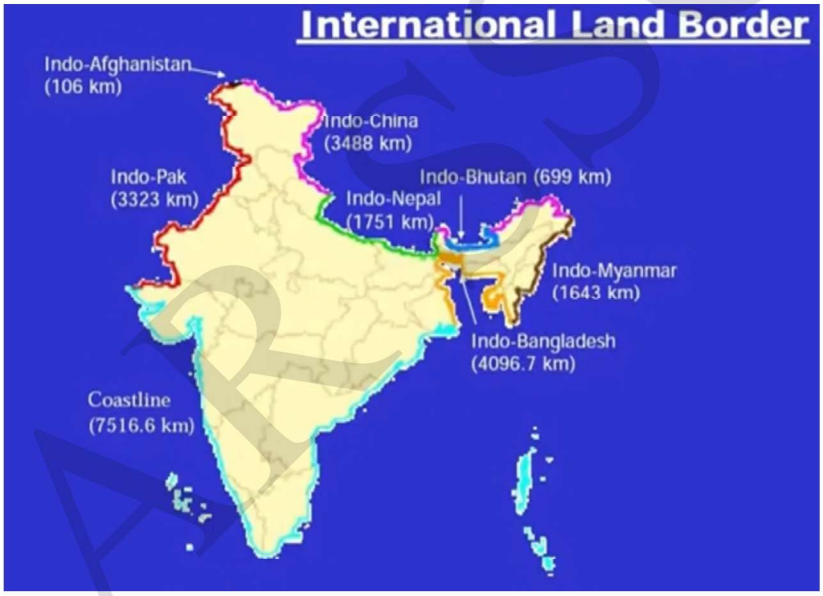
→3 states

Rajasthan	Mizoram	Tripura
Jaipur	Aizawl	Agartala

- Tropic of Cancer meets IST at: Korea, Chattisgarh (Baikunthpur)

- Countries that share boundary with India:
  - B: Bangladesh → 4,096.7 km (longest)
  - C: China → 3,488 km
  - P: Pakistan → 3,323 km
  - N: Nepal → 1,751 km
  - M: Myanmar → 1,643 km
  - B: Bhutan → 699 km
  - A: Afghanistan → 106 km (least)

total: 15,106.7 km



Bangladesh: India and Bangladesh → Radcliffe Line

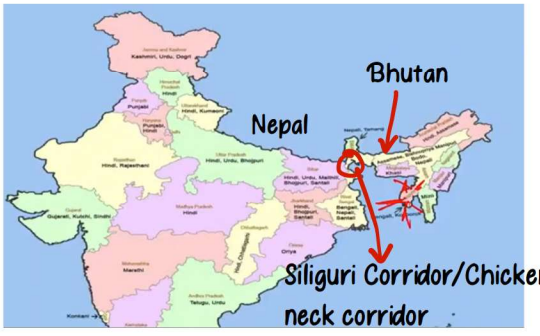
M → Meghalaya
A → Assam
M → Mizoram
Take → Tripura
Water → West Bengal

It is surrounded by Bangladesh from three sides

Train b/w Bangladesh to India
- Bandhan Express
- Mitali Express

Nepal

S → Sikkim
U → Uttar Pradesh
B → Bihar
B → West Bengal
U → Uttarakhand



Bhutan

B → West Bengal
A → Assam
S → Sikkim
A → Arunachal Pradesh

Pakistan: Pakistan and India → Line of Control (LOC) + Radcliffe Line → Agreed

G → Gujarat
R → Rajasthan
P → Punjab
J & K → Ladakh

Train b/w India and Pakistan:

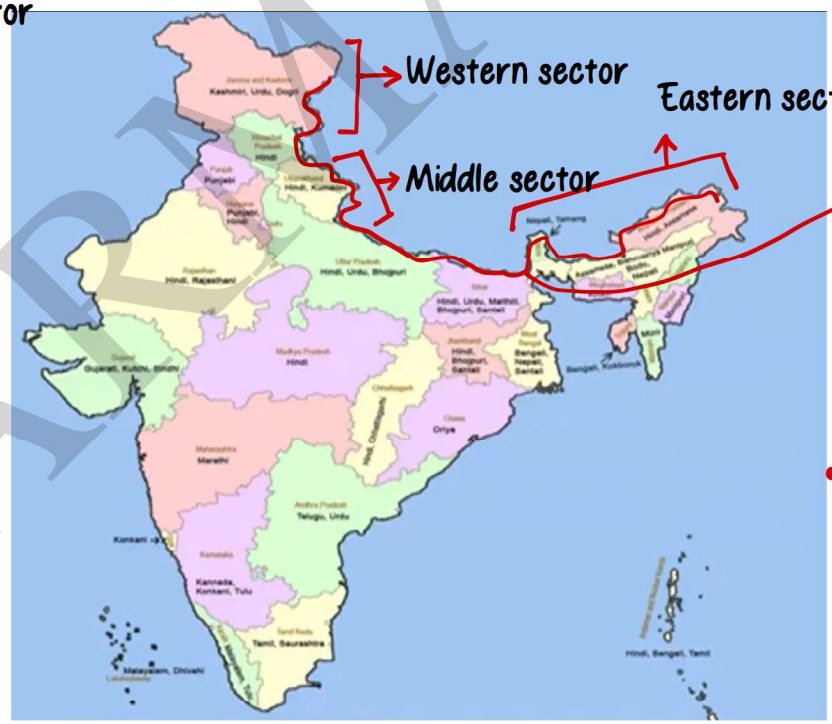
- Samjhauta Express
- Thar Express

Train to Pakistan (book): Khushwant Singh

China

Ladakh, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh

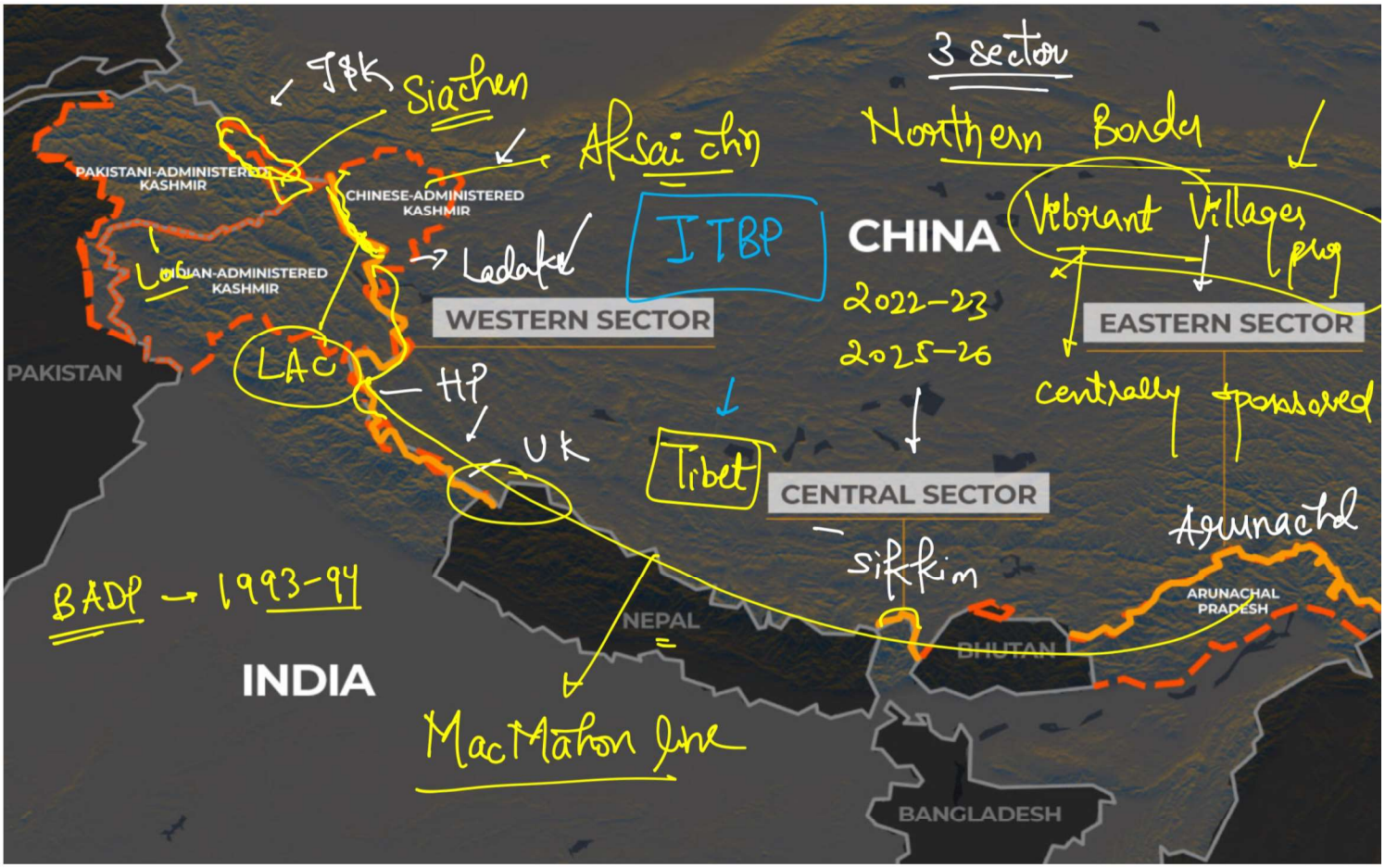
- **India-China Border divided into 3 sectors:**
  1. Western sector
  2. Middle sector
  3. Eastern sector



India-China Border divided into 3 sectors

- Vibrant Village Programme for development: India-China border

- Line b/w India and China: Line of Actual Control (LAC) → Not agreed
  Johnson Line
  McMohan Line


3 sector
Northern Border
J&K
Siachen
Aksai chin
PAKISTANI-ADMINISTERED KASHMIR
CHINESE-ADMINISTERED KASHMIR
INDIAN-ADMINISTERED KASHMIR
Ladakh
ITBP
CHINA
Vibrant Villages prg
2022-23
2025-26
WESTERN SECTOR
EASTERN SECTOR
PAKISTAN
LAC
HP
UK
Tibet
centrally sponsored
CENTRAL SECTOR
Arunachal
Sikkim
ARUNACHAL PRADESH
BADP → 1993-94
NEPAL
BHUTAN
INDIA
MacMahon line
BANGLADESH

- Border Road Organisation (BRO) → 1960

- Border Area Development Programme: 7th Five Year Plan → 1985-90

Land of thunderbolt
National sports: Archery

- Official language: Dzongkha
- Capital: Thimphu
- Currency: Ngultrum

- Nepal and Bhutan: SSB (under Ministry of Home Affairs)
- Pakistan and Bangladesh: BSF
- India and China: ITBP (under Ministry of Home Affairs)
- Naxalite affected areas: Red Corridor

Myanmar

- Old name: Burma
- Capital: Naypyidaw
- Currency: Kyat
- National sports: Chinlone (Caneball)

- Airforce/Navy/Army: Ministry of Defence
- Assam Riffles: Under Home Affairs but operation control under Ministry of Defence
- CRPF: Largest force of India

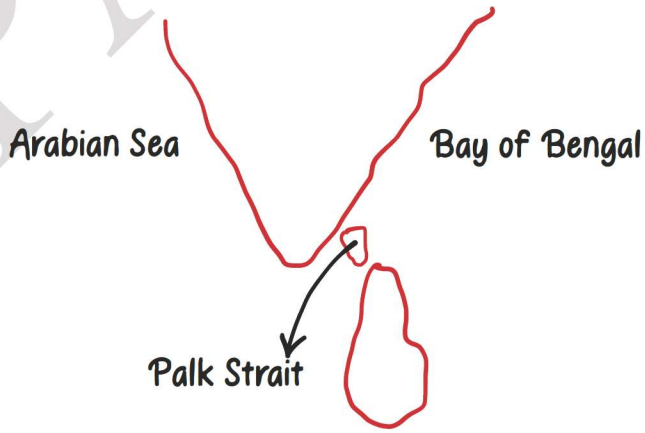
Aru → Arunachal
Na → Nagaland
Ma → Manipur
Mi → Mizoram

Afghanistan
Ladakh

- Capital: Kabul
- Currency: Afghan Afghani
- Language: Dari/Pashto
- Parliament: Shura/Shora

Sri Lanka and India separated by Palk Strait

a narrow passage of water connecting two seas or two other large areas of water



- Largest Gulf in the world: Gulf of Mexico
- Largest Bay in the world: Bay of Bengal

- State sharing boundary with maximum no. of state: Uttar Pradesh
  - 8 states + 1 UT (Delhi)

- State sharing boundary with least no. of states: Sikkim, Meghalaya
  - West Bengal
  - Assam

- States sharing boundary with 3 countries:
  1. Sikkim (Nepal, Bhutan, China)
  2. Arunachal (Bhutan, China, Myanmar)
  3. West Bengal (Nepal, Bhutan, Bangladesh

- 1 UT that shares boundary with 3 countries: Ladakh (Pakistan, China, Afghanistan)

Coastal Boundary of India

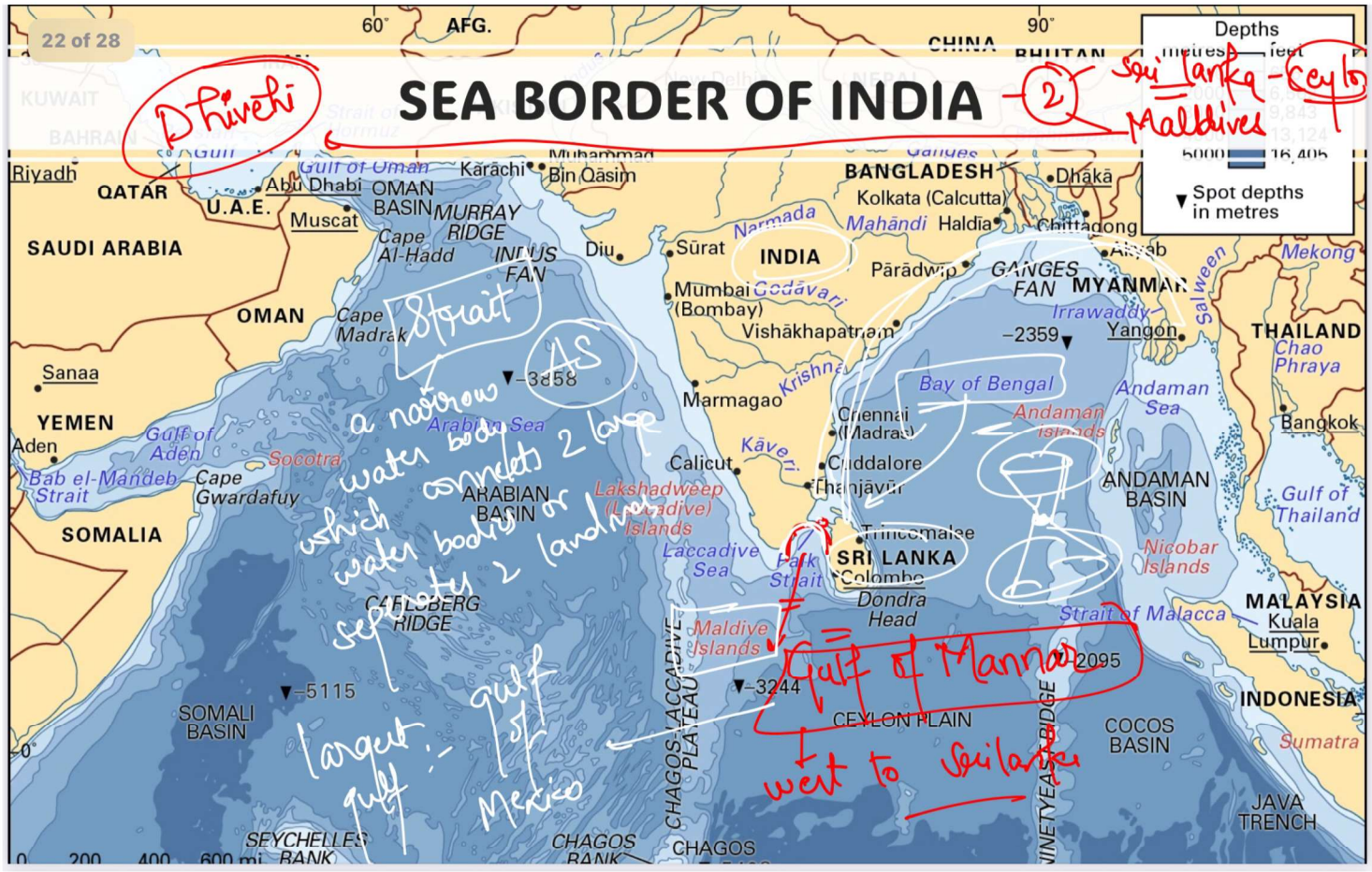
- Total: 7516.6 km
- Mainland: 6100 km
- States: 9
  - Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Odisha, West Bengal
- UTs: 4
  - Andaman and Nicobar Island, Lakshadweep, Daman and Diu, Puducherry

- longest coastal boundary of the world: Canada
- India is in 13th position

Longest coastline in India: Andaman and Nicobar (1912 km)

- State: Gujarat (1600 km)
- UT: Andaman and Nicobar (1962 km)

- Shortest coastline: Goa


SEA BORDER OF INDIA
D Tiwari
2
Sri Lanka - Ceylon
Maldives
Depths
Spot depths in metres
Strait
a narrow water body which connects 2 large water bodies or separates 2 landmasses
Largest gulf :- Gulf of Mexico
Gulf of Mannar
went to Sri Lanka
AS
AFG.
CHINA
BHUTAN
BANGLADESH
INDIA
MYANMAR
SAUDI ARABIA
QATAR
U.A.E.
OMAN
YEMEN
SOMALIA
SRI LANKA
THAILAND
MALAYSIA
INDONESIA
Riyadh
Abu Dhabi
Muscat
Kārāchi
Bin Qāsim
Dhakā
Kolkata (Calcutta)
Haldia
Chittagong
Sūrat
Diu
Mumbai (Bombay)
Pārādwip
Vishākhapatnam
Yangon
Sanaa
Aden
Socotra
Cape Gwardafuy
Bab el-Mandeb Strait
Cape Madrak
Cape Al-Hadd
Marmagao
Calicut
Chennai (Madras)
Cuddalore
Thanjāvūr
Trincomalee
Colombo
Dondra Head
Palk Strait
Laccadive Sea
Maldive Islands
Lakshadweep (Laccadive) Islands
Andaman Islands
Nicobar Islands
Strait of Malacca
Kuala Lumpur
Bangkok
Gulf of Thailand
Andaman Sea
Bay of Bengal
Arabian Sea
Gulf of Oman
Gulf of Aden
Narmada
Mahāndi
Godāvari
Krishna
Kāveri
Irrawaddy
Salween
Mekong
Chao Phraya
Sumatra
Java Trench
OMAN BASIN
MURRAY RIDGE
INDUS FAN
GANGES FAN
ARABIAN BASIN
CARLSBERG RIDGE
SOMALI BASIN
CEYLON PLAIN
ANDAMAN BASIN
COCOS BASIN
CHAGOS LACCADIVE PLATEAU
NINETYEAST RIDGE
SEYCHELLES BANK
CHAGOS BANK
CHAGOS
−3858
−5115
−3244
−2359
2095
60°
90°
0°
0 200 400 600 mi

Territorial Limit of India

- 12 nm = 22 km → To measure coastline
- Contiguous zone = 24 nm
- Exclusive Economic Zone: 200 nm → Nautical miles

- 1 nautical mile = 1.852 km

- UNCLOS: United Nations Convention on the Law of the Sea
- Adopted: 1982 and Came into force: 1994

5 zones:

- Internal Waters
- Territorial Sea
- Contagious Zone
- Exclusive Economic Zone (EEZ)
- High Seas

- India is lying entirely in: Northern Hemisphere

- India can be divided into 6 physiographic regions:
  1. Himalaya
  2. Peninsular Plateau
  3. Northern Plain
  4. Desert
  5. Island
  6. Coastal Plains

- India is 7th largest in the world

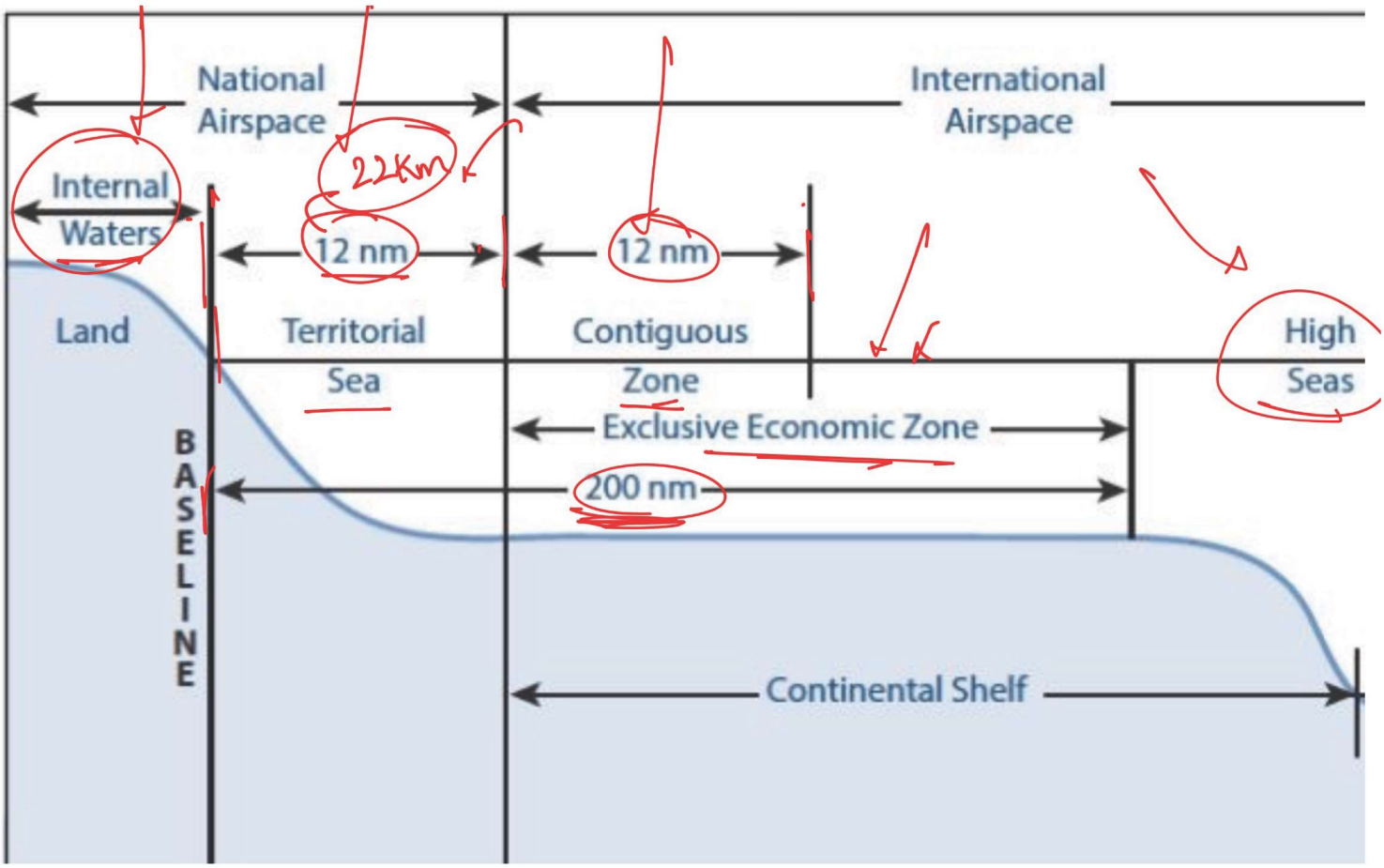
- India is bounded by the young fold mountains in the northwest: Himalayas

- Andaman and Nicobar is located on the Eastern Coast of India

- Gulf of Mannar (b/w India and Sri Lanka): Indian Ocean

- Languages of countries
  - Sri Lanka: Sinhala/Tamil
  - Maldives: Dhivehi
  - China: Mandarin
  - Bhutan: Dzongkha

- The place situated on three seas: Kanyakumari


National Airspace
International Airspace
Internal Waters
22Km
12 nm
12 nm
Land
Territorial Sea
Contiguous Zone
High Seas
Exclusive Economic Zone
200 nm
BASELINE
Continental Shelf

- Sites located on the hills near the Brahmaputra valley on the way to China and Myanmar: Daojali Hading → Jadeite stone is found here

- Line that separates Pakistan and Afghanistan/India and Afghanistan: Durand Line

- Afghanistan capital: Kabul
  Official languages: Pashto and Dari

- Two neighbouring islands of India: Sri Lanka and Maldives

- Water Treaty signed b/w India and Pakistan in year 1960: Indus Water Treaty

- Hill pass located between India and China: Karakoram Pass

- Havelock Island: Andaman and Nicobar Islands

- State capital located 530 meters above the sea level b/w 93 East longitude and 27 North latitude: Itanagar (Arunachal Pradesh)

- City situated along the Coromandel Coast: Tuticorin

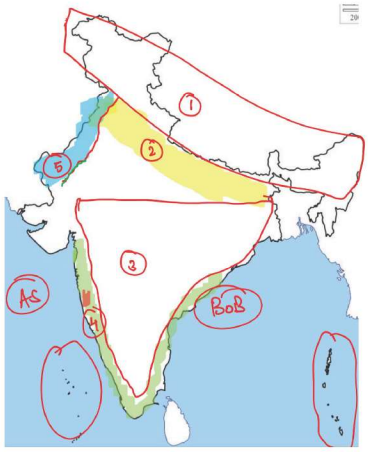
- Bordered by Bhutan and Arunachal in the North, Nagaland and Manipur to the East, Meghalaya, Tripura, Mizoram and Bangladesh to the South, West Bengal to the west: Assam

- Total area of the state Goa: 3702 km^2

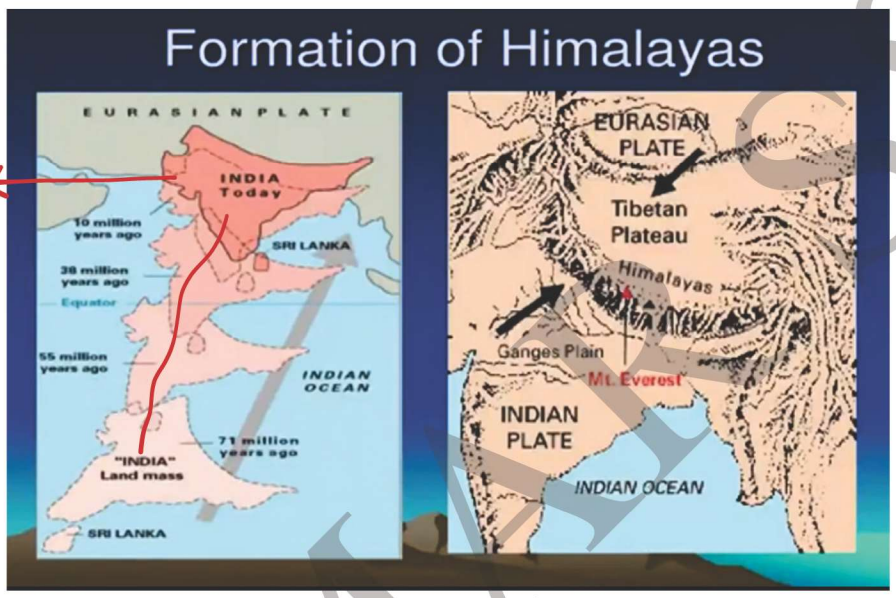
HIMALAYAS

India: 6 Physiographic Divisions

1. The Himalayas
2. Northern Plains
3. Peninsular Plateau
4. The Great Indian Desert
5. Coastal Plains
6. Group of Islands



Tethys Sea



Northern Mountains

Himalayas

Plate convergence

- Young fold mountains (formation: million of years ago)

Fold Mountains → Young, Old

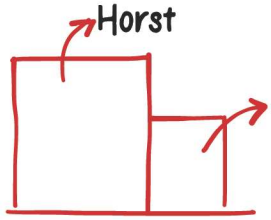
Eg:

Highest peaks

- Andes Mt. Range (South America) → Mt. Aconcagua
- Alps Mt. Range (Europe) → Mt. Blanc
- Rockies Mt. Range (North America) → Mt. McKinley (Mt. Denali)

- Old fold mountains: formed billion years ago
- Ural Mt. Range (separates Europe and Asia)
- Appalachians (North America)
- Aravalli (India)

Block Mountains



→ Is a valley floor that is part of rift valley

Eg:

- Vosges Mountain (France)
- Caucasus Mountains
- Vindhya
- Satpura
- Harz Mountains (Germany)

Volcanic Mountains

Eg:

- Mount Kilimanjaro (Africa)
- Mount Stromboli (light house of Mediterranean)
- Mount Fujiyama(Japan)
- Mount Ojas del Salado (Chile-Argentina border) → Highest volcanic mountain
- Mount Cotopaxi (Ecuador)
- Barren & Narcondam (Andaman & Nicobar)

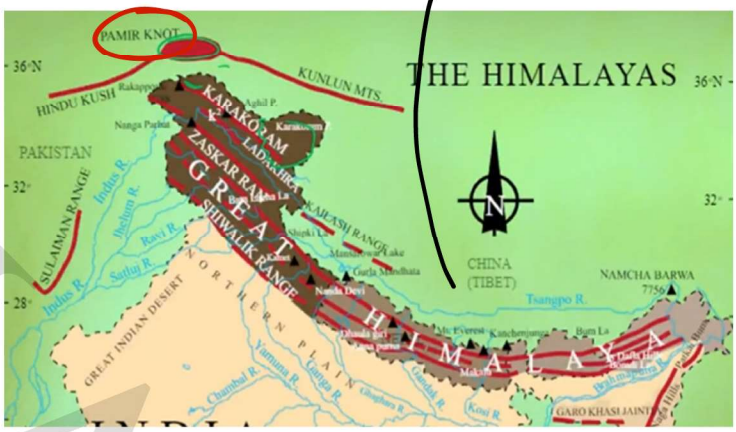
- Himalayas: core is made up of granitic rocks

Trans Himalayas → series of mountains

Himalayan Range → Great Himalayas → Known as Himadri; Middle Himalayas → known as Himachal; Shiwalik → Churiya Hills

- Trans Himalayas: 3 mountain ranges → Mt. Kailash is a part
  1. Karakoram Range: highest peak of this range is K2/Godwin Austin (8611 m, world's second highest peak) → Shyok river flows b/w Karakoram and Ladakh → Tributary of Indus
  2. Ladakh: high slope
  3. Zanskar → Indus flow b/w Ladakh and Zanskar

Tibet Plateau: known as Roof of the World



Glaciers of Karakoram Range:

1. Siachen → Operation Meghdoot (1984)
2. Baltoro → 2nd longest non-polar glacier of the world
   - Highest Battlefield
   - Core: Granitic rock
   - Asymmetrical folding
3. Hisper
4. Diafo

Tajikistan

- Longest glacier of the world: Lambert Glacier of Antarctica
- Longest non-polar glacier in the world: Fedchenko Glacier in Tajikistan

1. Great Himalayas/Himadri/Inner Himalayas
   - Western most point: Nanga Parvat
   - Eastern most point: Namcha Barwa → Syntaxial bending
   - Avg. height: 6000 m

Highest Peaks:

1. Mt. Everest (8848 m, highest in the world) — local names: Sagarmatha (Nepal), Chomolungma (Tibet)
2. Mt. Kanchenjunga (Sikkim): Highest in India (8598 m)
3. Mt. Lhotse: 8516 m (Tibet and Khumbu region of Nepal)
4. Dhaulagiri: 8167 m
5. Mt. Makalu: 8485 m
6. Annapurna: 8091 m

(4, 5, 6 — Nepal)

7. Nanda Devi: 7816 m (Highest peak in Uttarakhand)
8. Mt. Kamet: Uttarakhand

2. Lesser Himalayas/Middle Himalayas/Himachal Himalayas
   - Avg. Height: 4000 m
   - Width: 60-80 km

Names:

- J & K: Pir Panjal Range
- Himachal Pradesh: Dhauladhar
- Uttarakhand: Nagtibba
- Nepal: Mahabharat Range

- Valley: घाटी

- Kashmir Valley: b/w Great Himalayas and Lesser Himalayas

3. Shiwalik

- Avg. height: 1000 m
- Width: 10–15 km
- In the Eastern Himalayas gets replaced by Duars → Soft unconsolidated deposits → Good for tea cultivation
- B/w Lesser Himalayas and Shiwaliks: longitudinal valleys known a Duns
- Largest dun: Dehradun

Regional divisions of Himalayas

- Punjab Himalayas: b/w Indus river and Sutlej river
- Kumaon Himalayas: b/w Sutlej and Kali river
- Nepal Himalayas: b/w Kali and Teesta river
- Assam Himalayas: Dihang and Teesta river

Kashmir Himalayas: Karewas formation (glacial deposits)

- Lies b/w Great and Lesser Himalayas → Glacial deposits
- Lascustrine deposits → Zaffron (A local variety of saffron)

Lakes:

- Dal Lake, Wular Lake → fresh water lakes
- Pangong Tso, Tso Moriri → salt water lakes

Passes

- Banihal: Pir Panjal
- Photi La: Zanskar
- Khardung La: Ladakh range

- Jhelum River: Meanders in its youth stage → Srinagar

Himachal/Uttarakhand Himalayas

Lies b/w Kali in east & Ravi in west

- Tribe: Bhotia
- Summer grasslands: Bugyal

Important Hillstations

- Dharamshala
- Mussoorie
- Shimla

Darjeeling and Sikkim Himachal

- Mt. Kanchenjunga
- Tribe: Lepcha/Bhutia tribe
- Absence of Shiwalik → Duars

Arunachal Himalayas

jhumming cultivation practiced

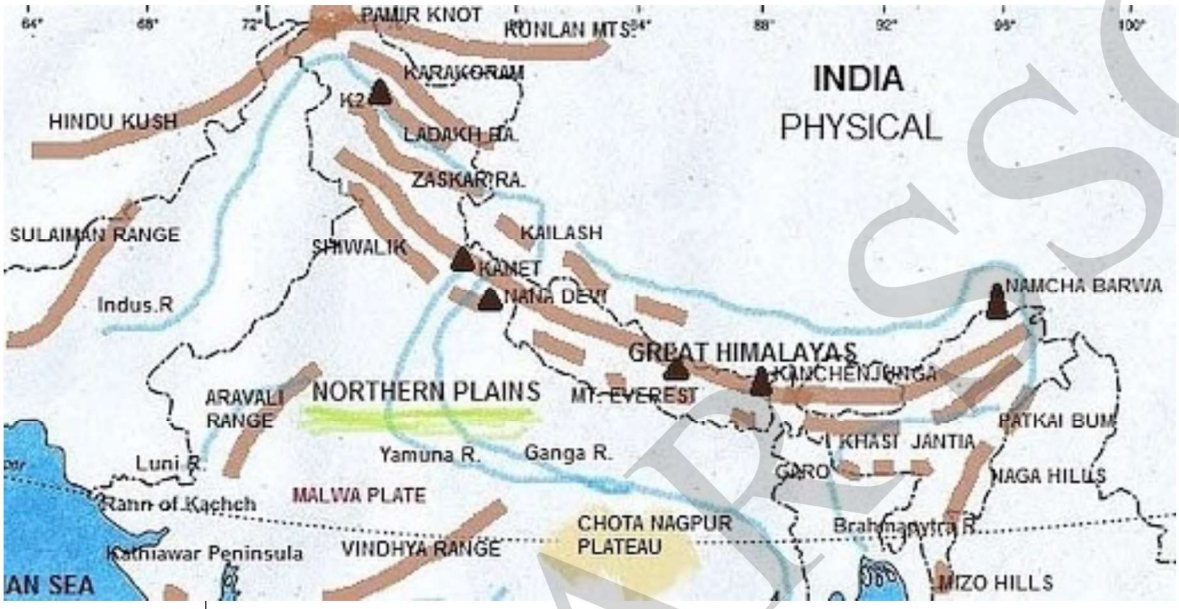
- Important peaks: Kangtu and Namcha Barwa
- Important rivers: Kameng, Subansiri, Dibang
- Tribes:

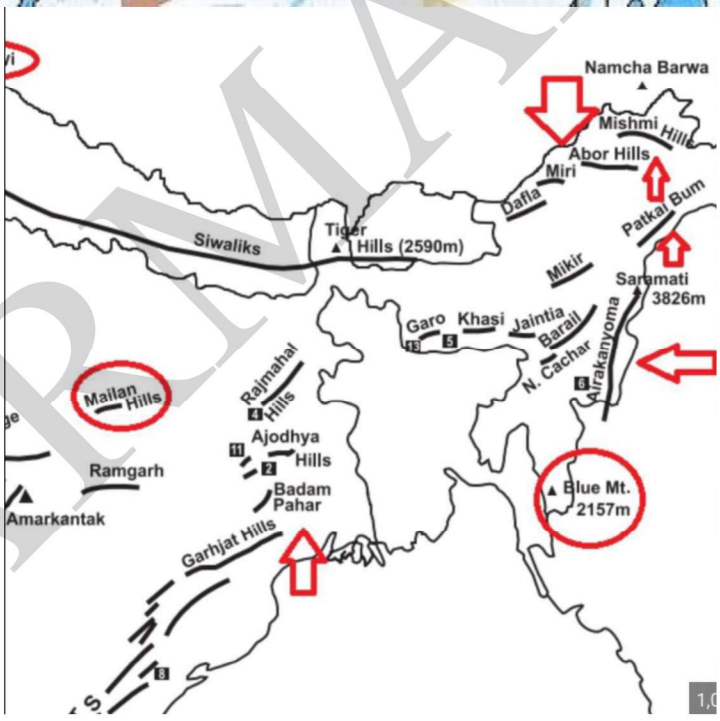
West → East

Monpa Abor Mishimi Nyishi Naga

Eastern/Purvanchal Hills

- Patkai bum
- Naga Hills
- Manipur Hills
- Mizo/Lushai Hills





Highest Peaks

- Arunachal: Kangto (7090 m
- Nagaland: Saramati peak
- Manipur: Mt. Esii (Tenipu)
- Mizoram: Phawngpui (Blue mountain)

- Barak River

↓

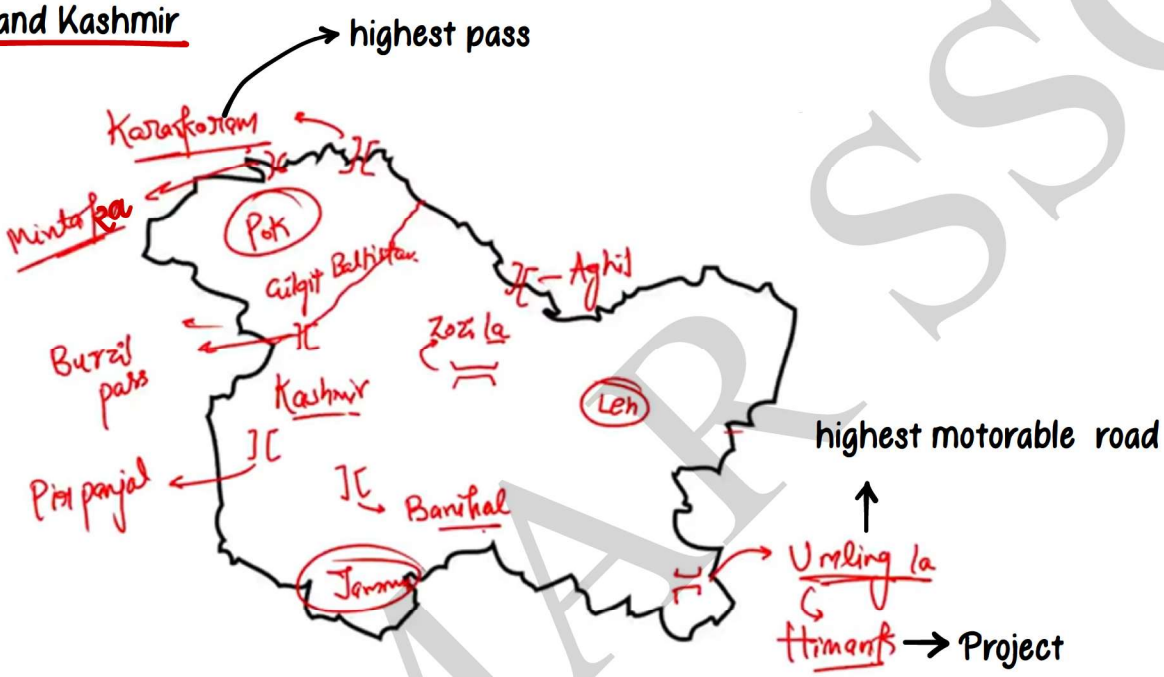
Mizoram: Molasses Basin (soft unconsolidated deposits)

Manipur: Loktak Lake → Keibul Lamjao National Park

- Floating National Park
- State Animal: Shanghai Deer

Passes

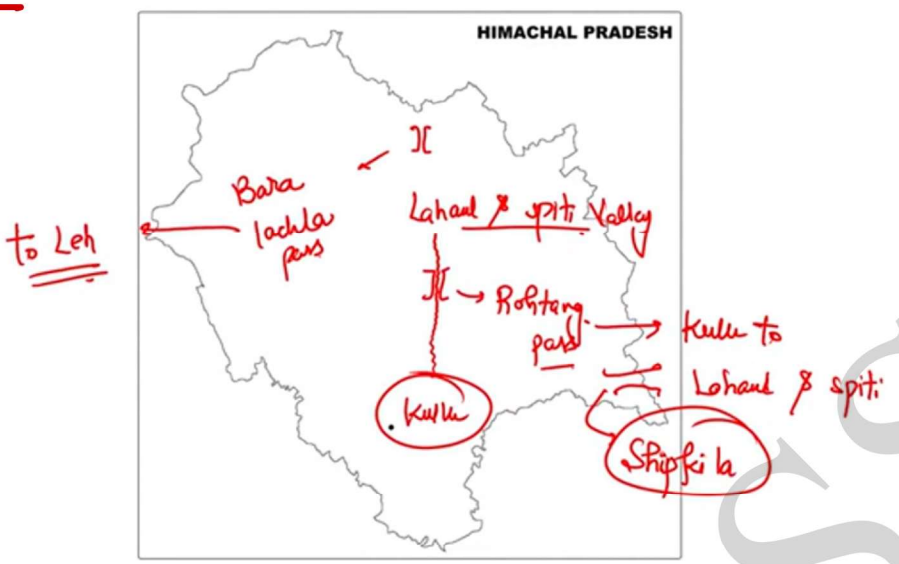
Jammu and Kashmir



- Jammu to Kashmir/Srinagar: Banihal and Pir Panjal

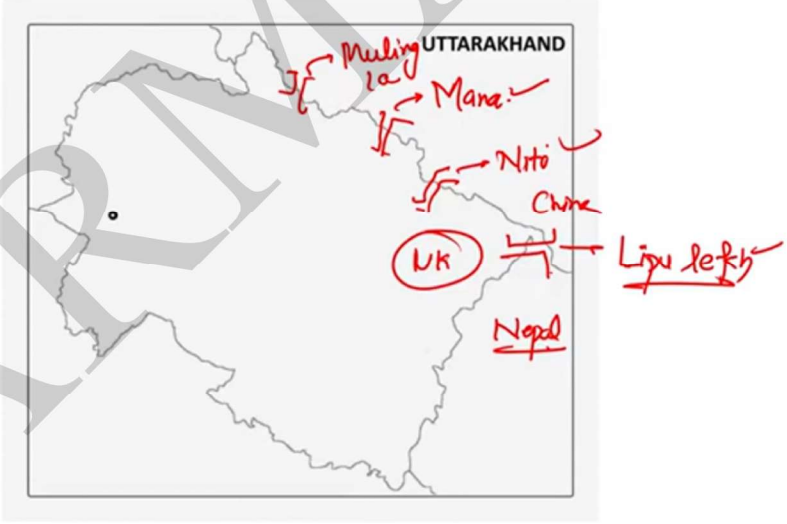
- Kashmir to Gilgit: Burzil
- Kashmir to Leh: Zoji La

Himachal Pradesh



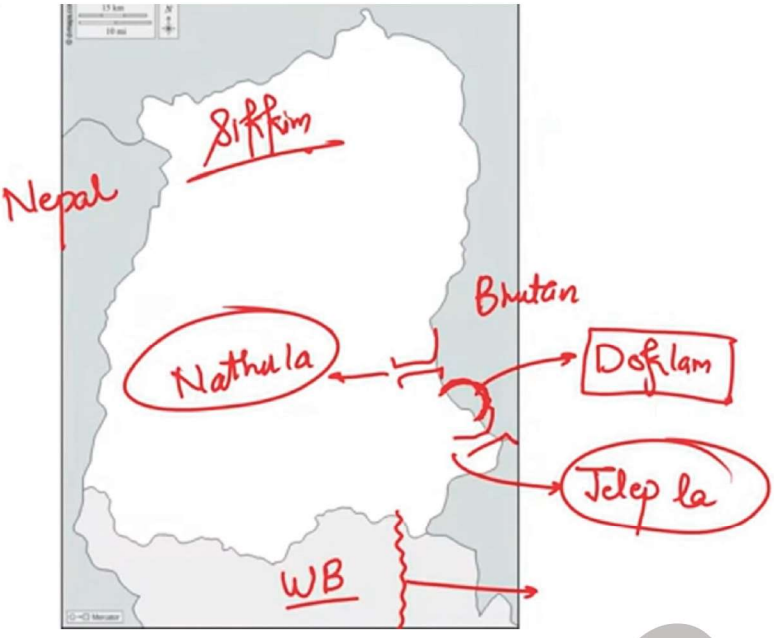
- Rohtang pass connects: Kullu to Lahaul and Spiti Valley
- Baralacha La Pass: Lahaul and Spiti to Leh
- Atal Tunnel in Rohtang Pass

Uttarakhand

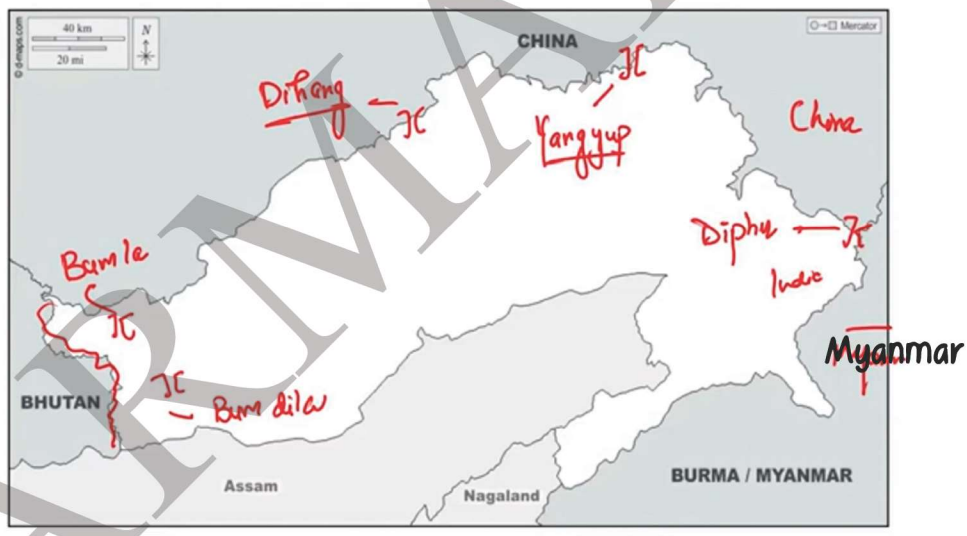


- Lipu Lekh located at Trijunction

Sikkim

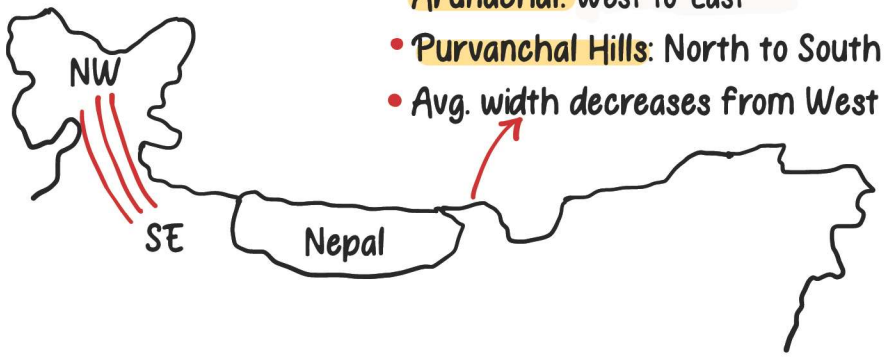


Arunachal Pradesh



General Orientation of Himalayas

- NW Himalayas: NW to SE
- Arunachal: West to East
- Purvanchal Hills: North to South
- Avg. width decreases from West to East



- Appalachians: North America Cold mountains
- Aravalli Cold)
- Ural Cold)

- Harz Mountains (Germany) → Block mountains

- Terai: Belt
  ↓
  Low land region in Northern India and Southern Nepal

- Mount Krakatoa: Indonesia

- Kotli Dun and Patli Dun located b/w: lesser Himalayas and Shiwaliks

- Highest peak in Peninsular India: Anaimudi

- White Mountain: Dhaulagiri (Nepal), covered with white snow

- Deomali, highest peak of: Odisha

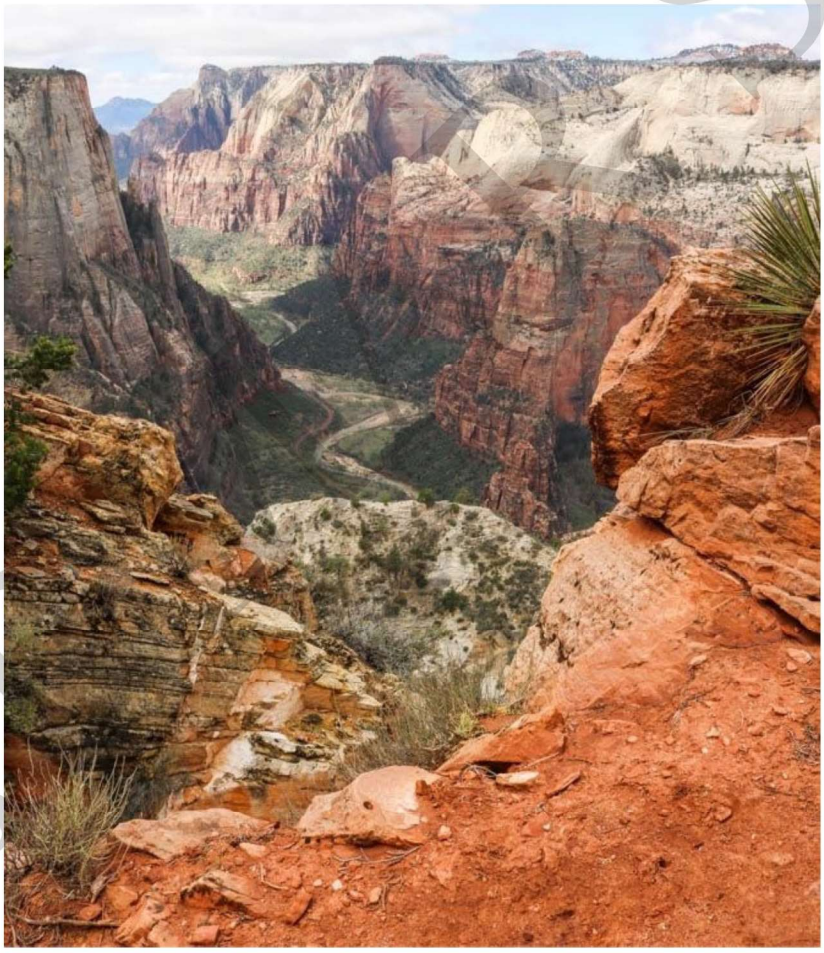
- Mount Tiyi: Nagaland

- Mountain near Dhauliganga: Nanda Devi

- Gorichen peak: Arunachal Pradesh

- Mountain b/w India and Nepal: Kanchenjunga

PENINSULAR PLATEAUS



triangular shaped

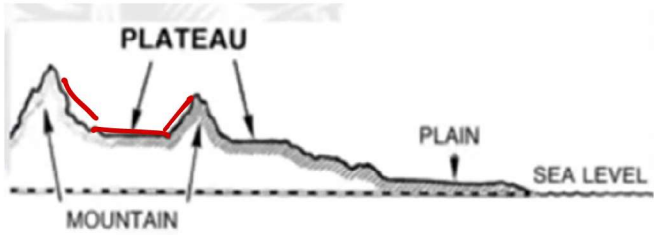
Peninsular Plateaus: Largest physiographic division

What is Peninsular?

- A land mass which is covered by water from three sides

What is a Plateau?

- A plateau is a flat, elevated landform that rises sharply above surrounding area on at least one side



The Peninsular Plateau

- A table land composed of the old crystalline, igneous, and metamorphic rocks

Formation:

- Due to breaking and drifting of Gondwana land Peninsular Plateau is made up of black soil (volcanic origin)
- It has broad and shallow valleys and rounded hills

Divisions

- Central Highlands
- Deccan Plateau

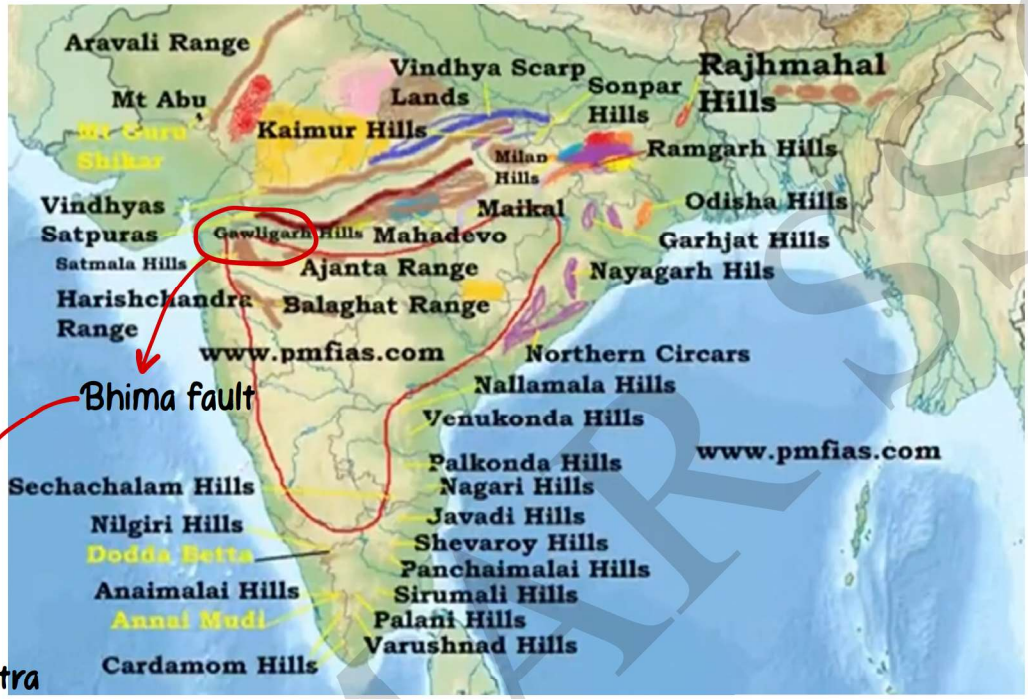
- Peninsular Plateau general elevation: 600–900 m

Satpura

- Block mountains
- 3 hills:
  Rajpeepla
  Mahadeo
  Maikal
- **Highest Peak:** Dhupgarh (Madhya Pradesh) located on Mahadeo Hills
- **Hill station:** Panchmarhi Hills → Queen of Satpura
- Amarkantak Plateau
  - Makes radial drainage pattern
  - Rivers that flow: Narmada and Son
  - abundant deposits of Bauxite

Vindhya

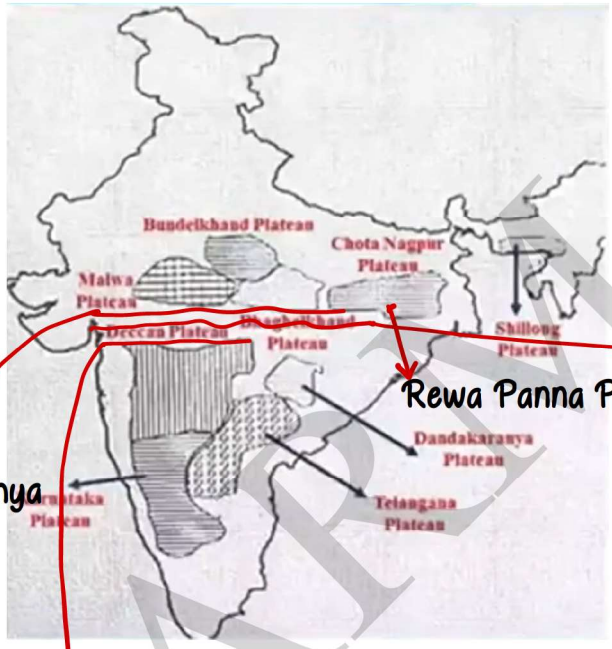
- Panna (Madhya Pradesh) → Famous for diamond
- Highest peak: Sadbhavna Shikhar (Peak of Goodwill)



Rift valley

Central Highlands

- Part lying to the North of Narmada River
- Covered by Vindhya, bounded by Satpura at South and Aravalis on the Northwest



Vindhya

Narmada river

Satpura

Main plateaus

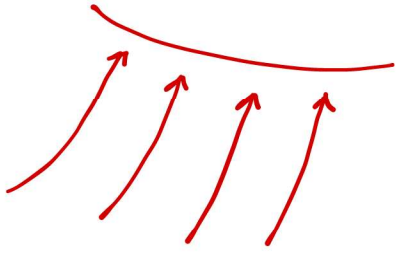
- Malwa Plateau (largest)–Western side
- Chota Nagpur Plateau–Eastern side

- Central Highlands are wider in West but narrower in the East
- (Bundelkhand and Baghelkhand)

- Topmost producer of Cotton: Maharashtra/Gujarat

Malwa Plateau

- In Gujarat, Rajasthan, and Madhya Pradesh
- Made of lava (Basaltic rock)
  - Black soil originates
- Rivers that flow: Chambal, Betwa, Sindh, Ken
  - From Southwest to Northeast
  - Tributaries of Yamuna



Aravalis: North West extension of Central Highlands

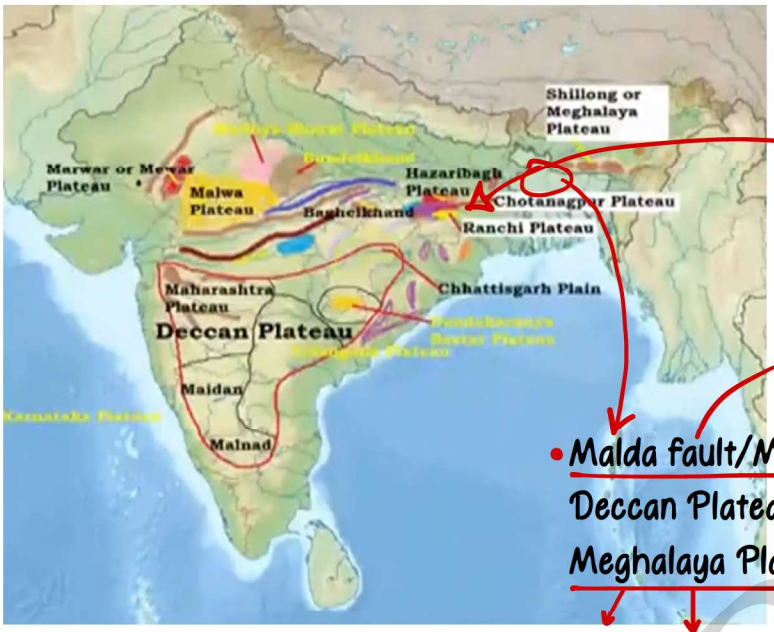
- Spread across 860 km
- Old fold mountains
- They are residual mountains
- Spread across: Gujarat, Rajasthan, Delhi, Haryana
  - Delhi → Raisina Hills
- Highest peak: Guru Shikhar (1722 m)
  - situated in Mt. Abu Hills
    - Temple located: Dilawara Jain Temple

Chota Nagpur Plateau

- Spread across Jharkhand, Chattisgarh, Odisha, West Bengal
- Also known as Ruhr State (famous for minerals)
- 3 important plateaus:
  - Ranchi Plateau
  - Hazaribagh Plateau
  - Koderma Plateau
- Highest peak: Parsavnath (also, name of 23rd Tirthankar)
- River that flows in rift valley: Damodar River (eastern side)
- Jadugada Mines: famous for Uranium

Deccan Plateau

- It is a triangular landmass lying South of river Narmada
  Borders
- Satpura: Northern borders
- Mahadev, Kaimur hills, and Maikal range: Eastern borders
- Tilted towards East
  - The Deccan Plateau is higher in the west and slopes gently eastwards
- An extension of these plateaus is found in North East
  - Meghalaya plateau (Garo, Khasi and Jaintia Hills), Karbi Anglong plateau and North Cachar hills
    - → Assam



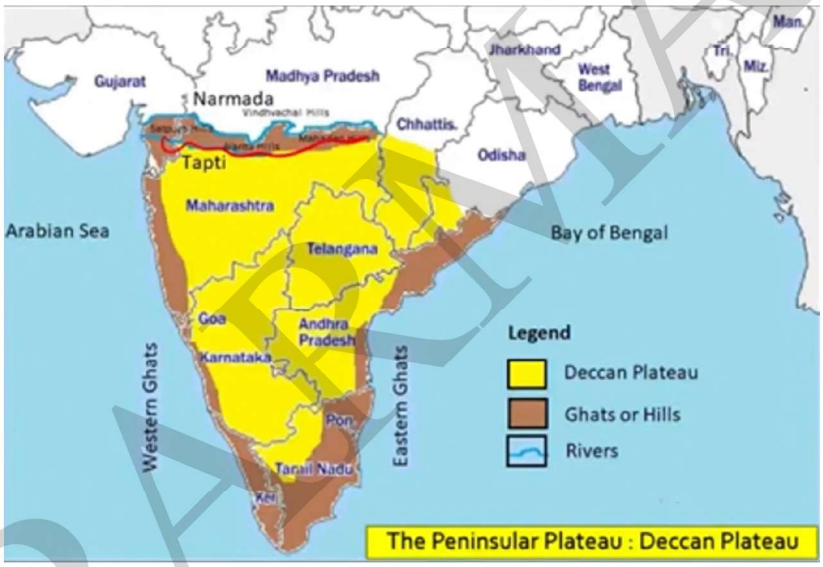
Rajmahal Hills: makes North Eastern boundary of Deccan Plateau

West Bengal

- Malda fault/Malda gap: Separates entire part of Deccan Plateau from Karbi Anglong Plateau/ Meghalaya Plateau/North Cachar Plateau

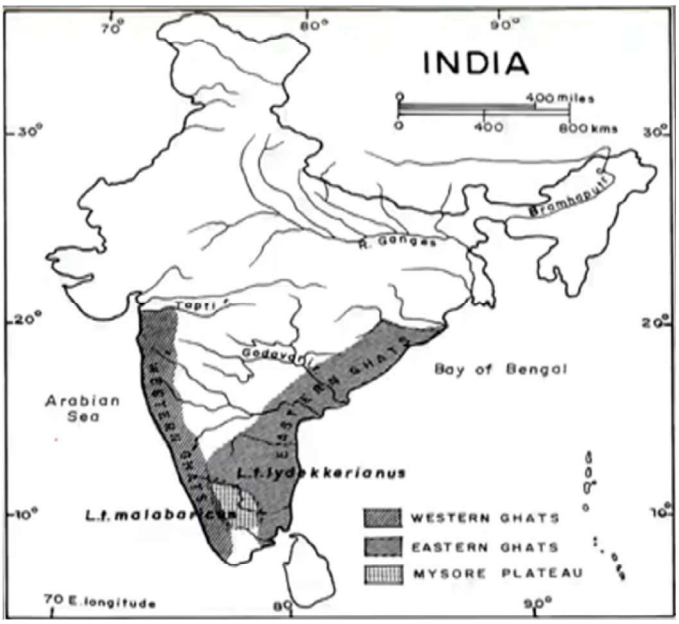
Garo Khashi Jayantia (Hills) Mikir Hills Rengma Hills

Cherrapunji, Mawsynram (highest rainfall in India), Shillong



Western Ghats and Eastern Ghats

- Both Western Ghats and Eastern Ghats lies west and east of the Deccan Plateau respectively
- Both the ghats have some distinctive features and differentiating points
- These are block mountains

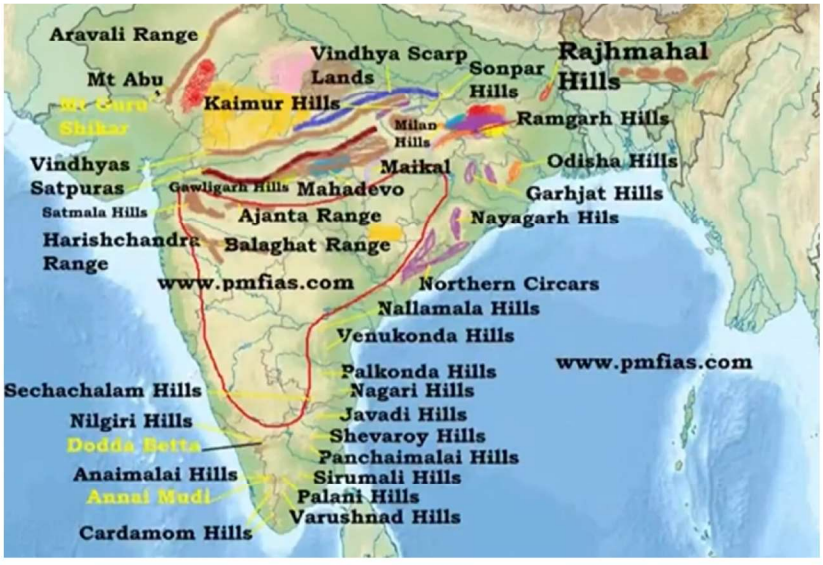


Western Ghats

- Continous and can be crossed through passes only
- Higher than eastern: 900–1600 m
- Stretch from Tapi to South of Nilgiri Hills
- Spread across: Gujarat, Maharashtra, Karnataka, Kerala, Tamil Nadu, Goa
- Cause Orographic rainfall
- Height increase from North to South
- Highest peak: Anaimudi (Anaimalai Hills)– 2695 m → Kerala
- 2nd highest peak: Doddabetta (2637 m) → on Nilgiri Hills; Ooty is here (Hill station); Tamil Nadu
- Southernmost Hills: Cardamom Hills

Eastern Ghats

- Discontinuous, irregular, and Dissected by rivers
- Stretched from Mahanadi Valley to the Nilgiri → Connects Western Ghats to Eastern Ghats
- Highest peak: Mahendragiri (1501 m)/ Jindhagada (1690 m)
- Shevaroy Hills and Javadi Hills are located to the southeast to it



Passes

- Bhorghat: Mumbai to Pune
- Thalghat: Mumbai to Nasik
- Pal Ghat: Annamalai to Nilgiri

- Mountain Peak at the mountainous border of Indian state of Nagaland and the Sagaing region of Myanmar: Mount Saramati

- Mountains in the northwest, north, and northeast bind India: Young fold mountains

- Mount Jopuno: Sikkim

- Kumaon Himalayas is between Sutlej and Kali

- Oldest mountain/hills range in India: Aravali Hills

- Lipu Lekh pass: Uttarakhand
  ↓
  Located at tri-junction
  India, Nepal, and China

- Mountain that looks like a giant pyramid and has a flat summit area and two peaks: Kamet

- Core of Great Himalayas is composed of: Granite (igneous rock)
  ↓
  continental crust

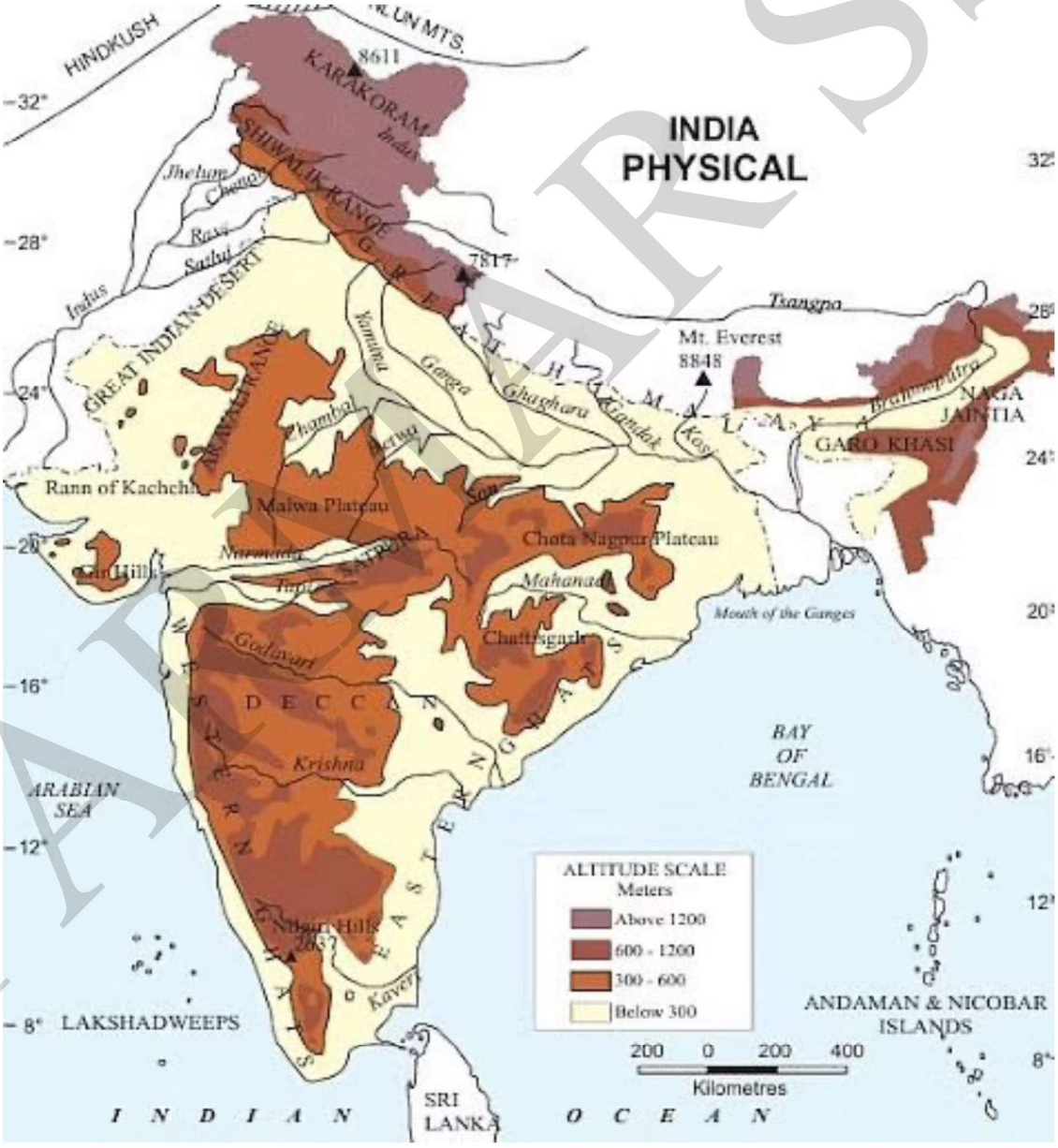
- Oceanic Crust: made of Basaltic rock, is denser and is thin

- Rohtang pass cuts through Pir Panjal range and links Manali and Leh by road

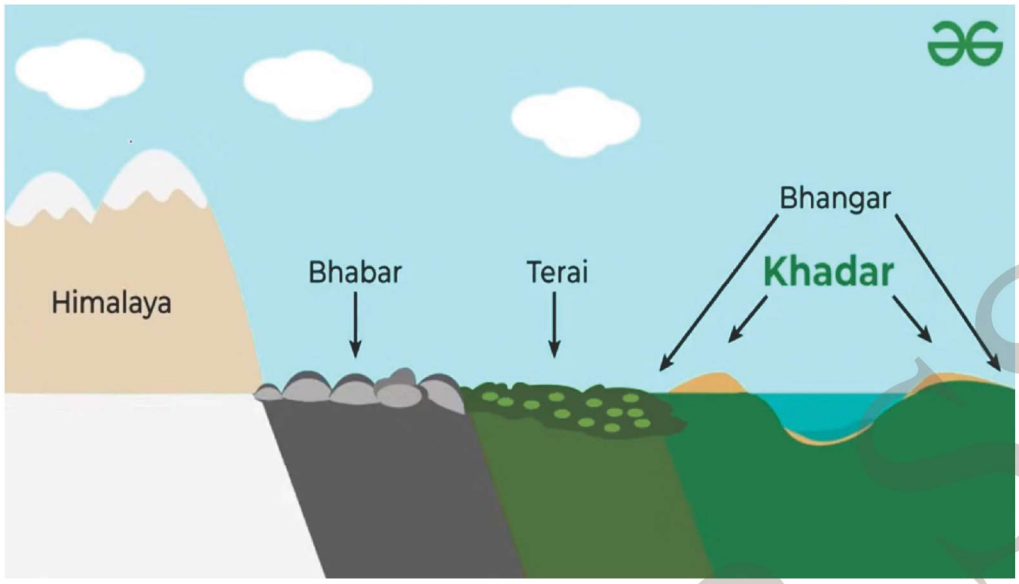
- Ladakh range extends from northern side of Leh to the Tibetan Border and comprises Digar La Pass and Khardung La Pass

- K2 mountain is situated near Siachen region of Ladakh in India
- Jawahar Tunnel: Banihal Pass (J&K and Srinagar)
- Land route to Kailash and Mansarovar passes through: Mana Pass
- Javadi: Eastern Ghats peak
- Nilachal Hills: Guwahati
  - Kamakhya Temple is situated here
- Fotu La (4108 m) is highest point of Ladakh under Zanskar mountain range
- Highest hill station: Leh
- Hills in Andhra Pradesh: Nagari Hills
- Borra Caves in Andhra Pradesh is situated on the East Coast of India in: Ananthagiri Hills
- Patkai bum: Eastern part of India
- Shatrunjaya Hills located in Gujarat
- Maikal is a range not a plateau
- Deccan Plateau spread across: Telangana, Maharashtra, Karnataka, Kerala, Andhra Pradesh , Madhya Pradesh, Chattisgarh, Tamil Nadu

NORTHERN PLAINS AND ISLANDS



Northern Indian Plains



River in youthful stage → performs erosion

Bhabar
- streams of river disappear
- big stone pebbles seen here

Terai
- streams of river will reappear
- without properly demarcated channel
- marshy area
- lush green vegetarian seen here

Alluvial flood plain

Khadar
- New deposition
- Better fertility than bhangar
- renews every year

Bhangar
- Old deposition
- More calcareous concentration → Kankad

Coasts of India

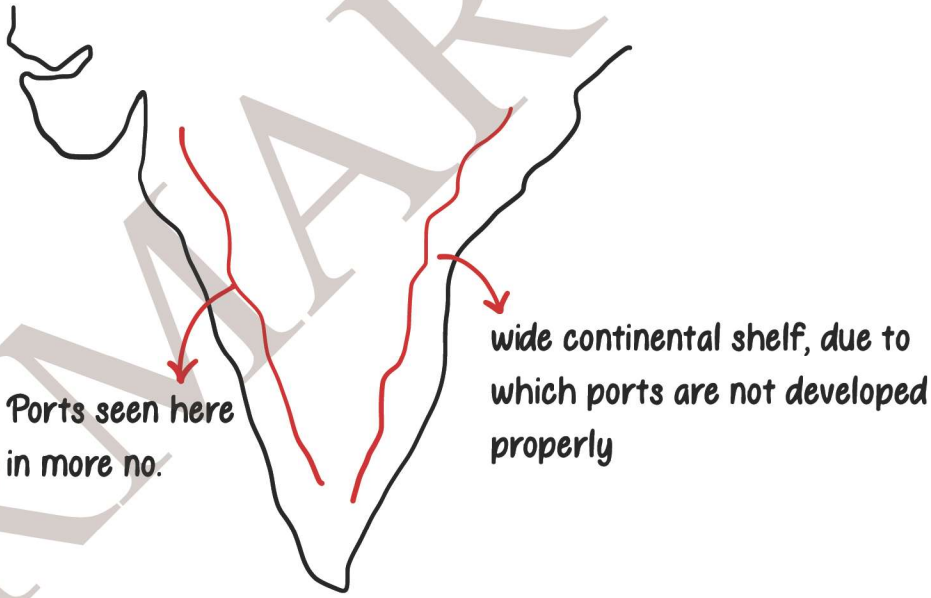
- 9 coastal states + 4 UTs

Western Coastal Plains

- Narrow in middle and wider in the ends
- Submerging
- Rivers do not form delta
- Formation of Kayals (Backwaters) → Punnamada Kayal: Nehru Trophy (Boat race)
- Port development is easy

Eastern Coastal Plains

- Wider
- Emerging
- Form Delta



- World's largest continental shelf: Siberian Shelf → In Arctic Ocean

Western Ghats is known as Sahyadri in Maharashtra

Ports of India

- Major
  - 13 ports
    - 12
      - Govt. Owned
        - Ownership and management by Central Govt.
    - 1
      - Pvt.
        - Ennore (Kamrajkar Port)
- Minor
  - 200
    - Owned by State Govt.

Tidal port

Also known as Deendayal Port Trust

- Also, Nhava Sheva Port
- Largest container port

In Zuary river's estuary

Queen of Arabian Sea

Only state to have max. major ports

oldest port developed by British in 1870s

Haldia Port (West Bengal)

- Riverine port
- Also known as Shyama Prasad Mookerjee Port

India's deepest landlocked port

Great Indian Dessert

- Seen in North Western of Aravali
- Low rainfall: < 150 mm/year
- Also known as Marusthali
- Most rivers are ephemeral

Features:

- Barchans, Seif
- Mushroom rocks
- Pedestrial rocks

- Oasis is seen here
  - green part in desert

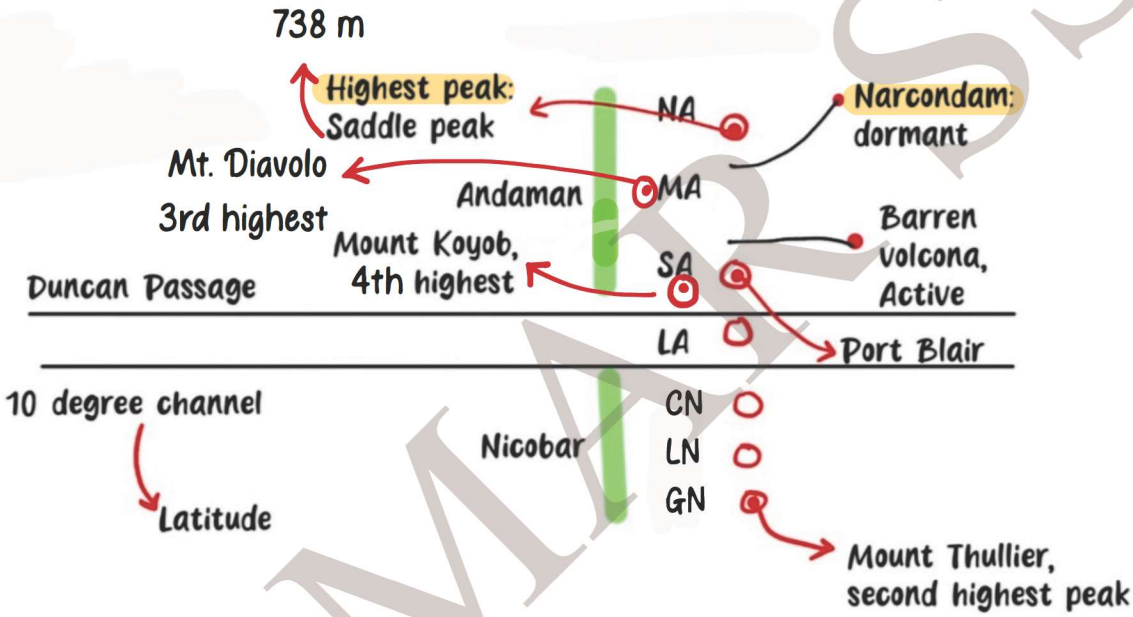
Rajasthan

Islands: Part of land surrounded by water from all four sides

made of coral deposits

Arabian Sea
- Lakshadweep
- Total: 36 islands
- Largest: Andrott

Bay of Bengal
- Andaman and Nicobar group of islands → extension of Arakan Yoma (in Myanmar)
- Total: 572 islands
- Largest: Great Nicobar

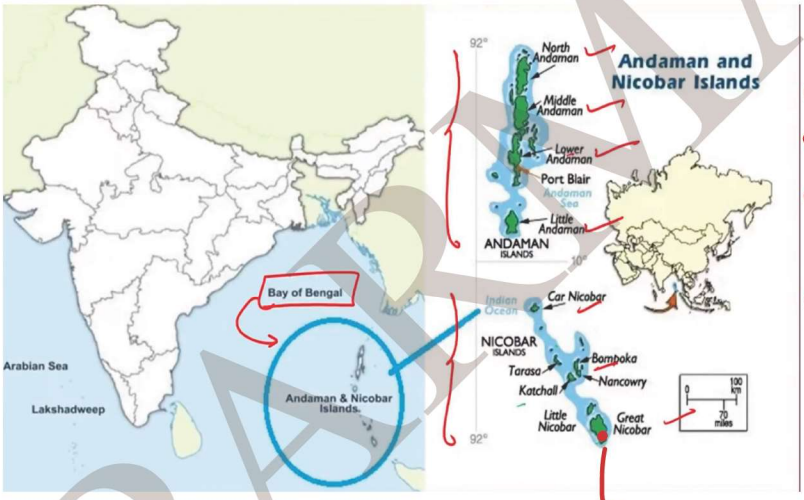


10°channel
- separates Andaman group of Islands and Nicobar group of Islands
- separates Little Andaman and Car Nicobar

Duncan Passage: Separates South Andaman and Little Andaman

Tribes
- Andaman: Negrito group → North Andamanese, Jarawa, Onge, Senthelese
- Nicobar → Shompen, Nicobarese

National Parks in Andaman and Nicobar



Islands renamed:

- Ross Islands → Netaji S. C. Bose Island
- Neil Island → Shaheed Dweep
- Havelock Island → Swaraj Dweep

- Unnamed islands were renamed on 21 Paramveer Chakra Awardees name

Pygmalion point

11°channel: separates Aminidivi and Cannanore

8°channel

- Minicoy from Maldives
- Lakshadweep from Maldives

Nine Degree Channel → Entire group of Lakshadweep from Minicoy

Minicoy

Sir Creek
Disputed territory between India and Pak

Alia Bet Island

New Moore Island
b/w India and Bangladesh

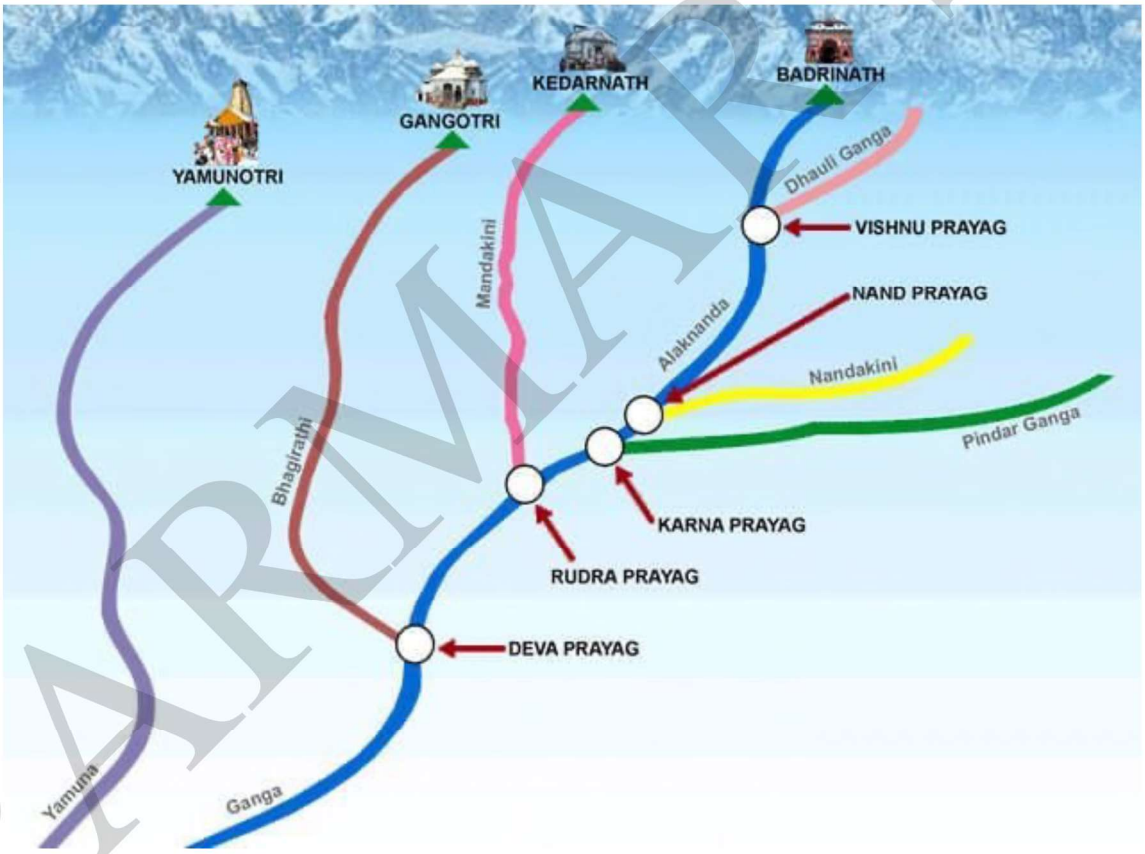
Chandipur, Odisha

APJ Abdul Kalam Island
Integrated Test Range (missile testing)

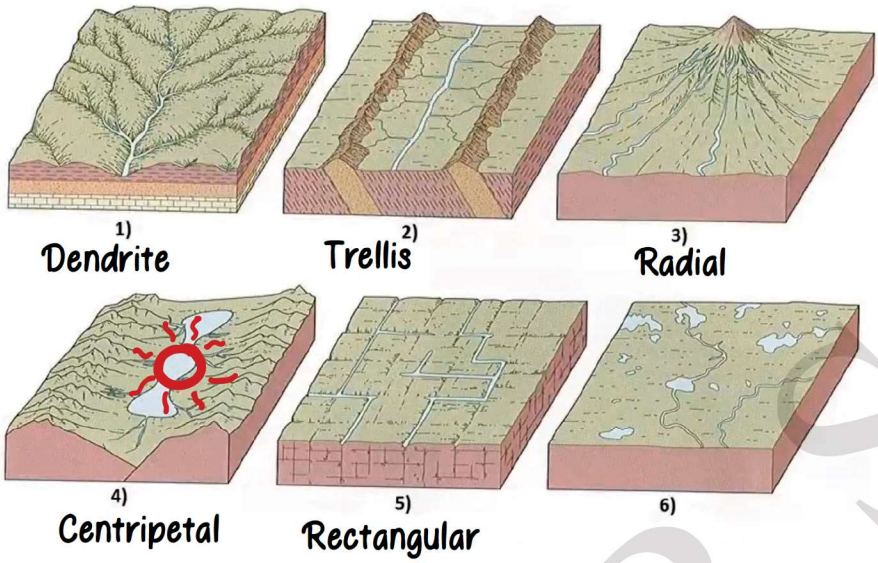
Pamban Island

Kachchatheevu Islands
b/w India and Sri Lanka

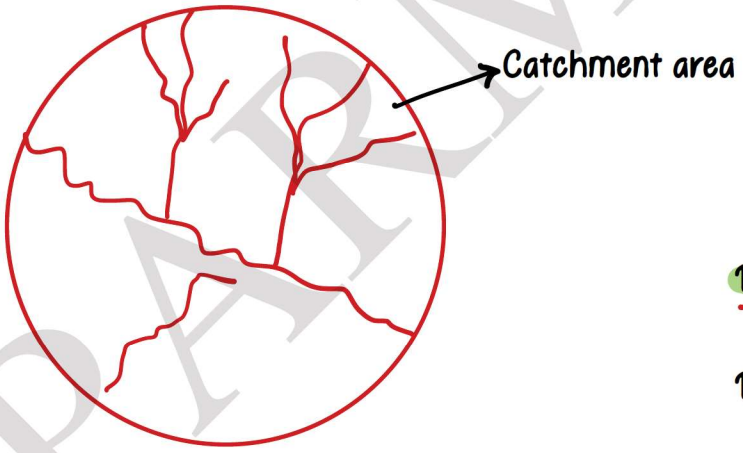
DRAINAGE SYSTEM



Different Drainage Patterns



1. **Dendritic**: resemble the branch of a tree
2. **Trellis**: tributaries join the river at right angle
3. **Radial**: rivers originating from a central dome/peak
4. **Centripetal**: rivers draining their water into a central lake/depression



River System

River + Tributaries

↓

Basin/Catchment area

Indian River System

1. Himalayan River System
2. Peninsular River System

- **Origin**: source
- **Mouth**: Drains water

The Himalayan Rivers

1. They are perennial
2. Water throughout the year (Origin/ Source: Glaciers)
3. They have long courses from their source to the sea
4. 3 major rivers: the Indus, Brahmaputra, and Ganga originating from the North of the mountain ranges
5. Ex: the Indus, the Brahmaputra, the Ganga
6. Some Himalayan rivers are antecedent (following their original course), eg: Satluj, Kosi, Indus

The Peninsular River

1. They are ephemeral
2. During dry season, large rivers have reduced flow of water in their channels
3. They have shorter and shallower course
4. Most of the rivers here originate in the Western Ghats and flow towards Bay of Bengal
5. Ex: Narmada, Tapi, Godavari

INDUS RIVER SYSTEM

Tributaries of Indus

↓

Jhelum+Chenab+ Beas+Ravi+Sutlej = Panchnad

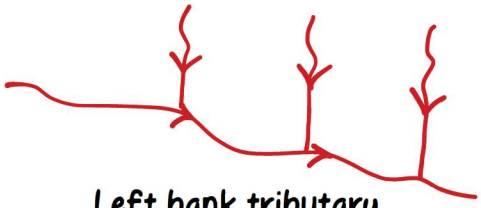
↓

Punjab

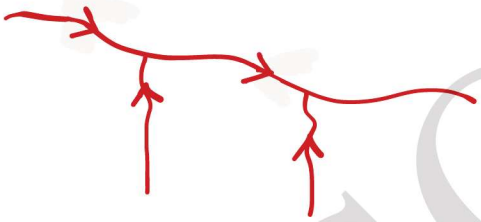
- Panj + Doab → Area between two rivers

Classification of Tributaries

1. Left Bank Tributary
2. Right Bank Tributary



Left bank tributary



Right bank tributary

- **Indus+Jhelum**: Sindh Sagar Doab
- **Jhelum+Chenab**: Jech Doab
- **Chenab+Ravi**: Rechna Doab
- **Ravi+Beas**: Bari Doab
- **Beas+Sutlej**: Bist Doab

Indus

- **Length**: 2880 km/1114 km in India
- **Flows in**: China → India → Pakistan
- National river of Pakistan
- Indus Water Treaty, 1960
  - Signed in Karachi
  - B/w J L Nehru and Ayub Khan
  - **Mediator**: World Bank
  - One of the most successful treaty around the world

Indus, Jhelum, Chenab	80% water used by Pakistan, 20% water used by India
Ravi, Beas, Sutlej	80% water used by India, 20% water used by Pakistan

- **Indus origin**: Bokhar Chu Glacier near Lake Mansarovar
- **Drains**: into Arabian Sea
- **Demchok**: enters into India
- **Leh**: located on the banks of Indus River
- Indus in Tibet is known as **Singi Khamban** (Lion's mouth)

Tributaries of Indus

1. Jhelum: meanders in its youthful stage

- Ancient name: Vitasta
- Origin: Verinag (J & K)
- Srinagar is located on the banks of Jhelum
- Wular lake gets its water from Jhelum
  - Largest freshwater lake

2. Chenab → Chandra + Bhaga

- Ancient name: Askini
- Origin: Baralacha La pass
- Largest tributary of Indus

3. Ravi

- Ancient name: Purushni
- Origin: Rohtang pass
- Flows in the border of India and Pakistan → Transboundary river

4. Beas

- Ancient name: Bipasha
- Origin: Rohtang pass
- Only tributary of Indus that does not pass or enter Pakistan

5. Sutlej → Longest tributary of Indus

- Ancient name: Shutudri
- Origin: Rakas lake (Lake Mansarovar)
- It enters India through Shipkila pass

- Panchnad meet Indus at Mithankot, Pakistan

- Right Bank Tributaries: Shyok, Gilgit, Hunza

GANGA RIVER SYSTEM

Largest river system in India

Goumukh Glacier

Gangotri

Bhagirathi

Vishnu Prayag

Nanda Prayag

Satopanth Glacier

Dhauli Ganga

Mandakini

Pindar

Nandakini

Karna Prayag

Alaknanda

Rudra Prayag

Ganga

Devprayag

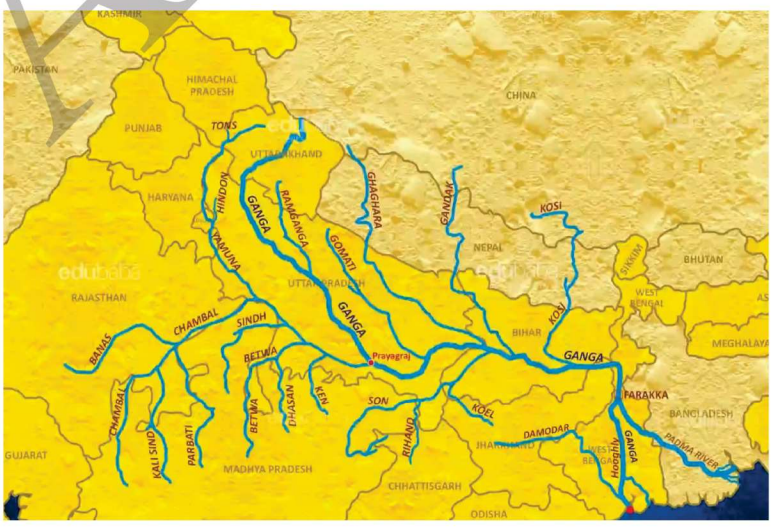
Gangetic dolphins: Endangered

Susu dolphins

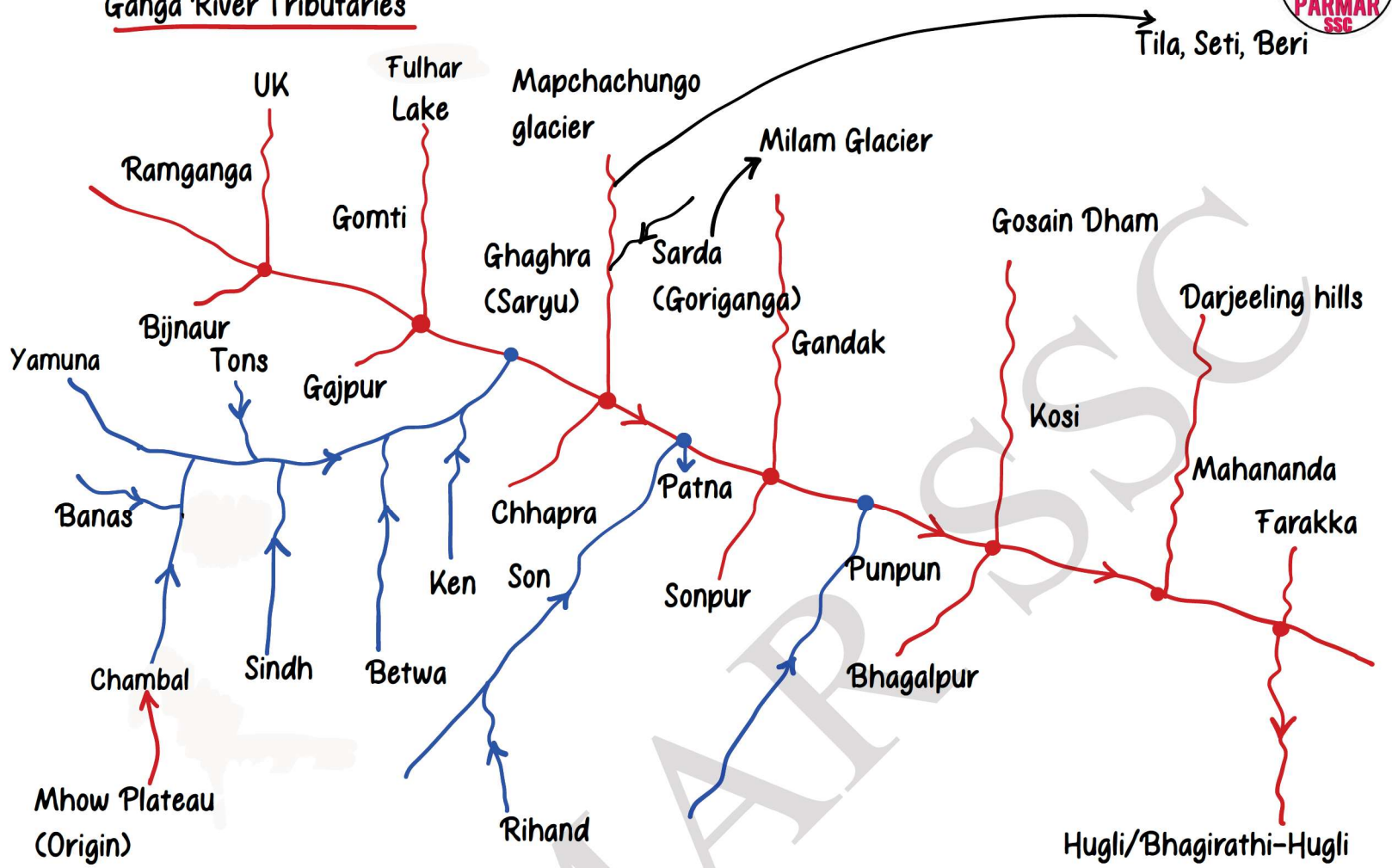
- **Prayag:** Confluence of two rivers

Distributary of Ganga

Alaknanda
- Bhagirathi → Dev Prayag
- Dhauliganga → Vishnu Prayag
- Nandakini → Nanda Prayag
- Pindar → Karna Prayag
- Mandakini → Rudra Prayag



Ganga River Tributaries



Origin: Banderpoonch peak

Yamuna: 1370 km

- It is the longest tributary of Ganga
- Tributaries: Chambal, Sindh, Betwa, Ken, Tons
  - Tons → Largest tributary
  - Chambal → Origin: Mhow Plateau → Badland Topography due to Ravines (gully erosion)
  - Chambal → Janapav hills
  - Tributaries:
    - Parbati
    - Kalisindh
    - Shipra

Son

- Origin: Amarkantak Plateau (Radial Drainage Pattern)
- Tributaries: Koel, Rihand
- Punpun: joins Ganga at Fatuha near Patna

- Ganga then flows in Bangladesh where it known as Padma
- Water from Ganga stored in bottle remains fresh due to presence Bacteriophage viruses
- Total length: 2525 km
- National River of India, declared in 2008
- Longest River of India
- Passes through 5 states: Uttarakhand, Uttar Pradesh (longest), Bihar, J&K (shortest), West Bengal

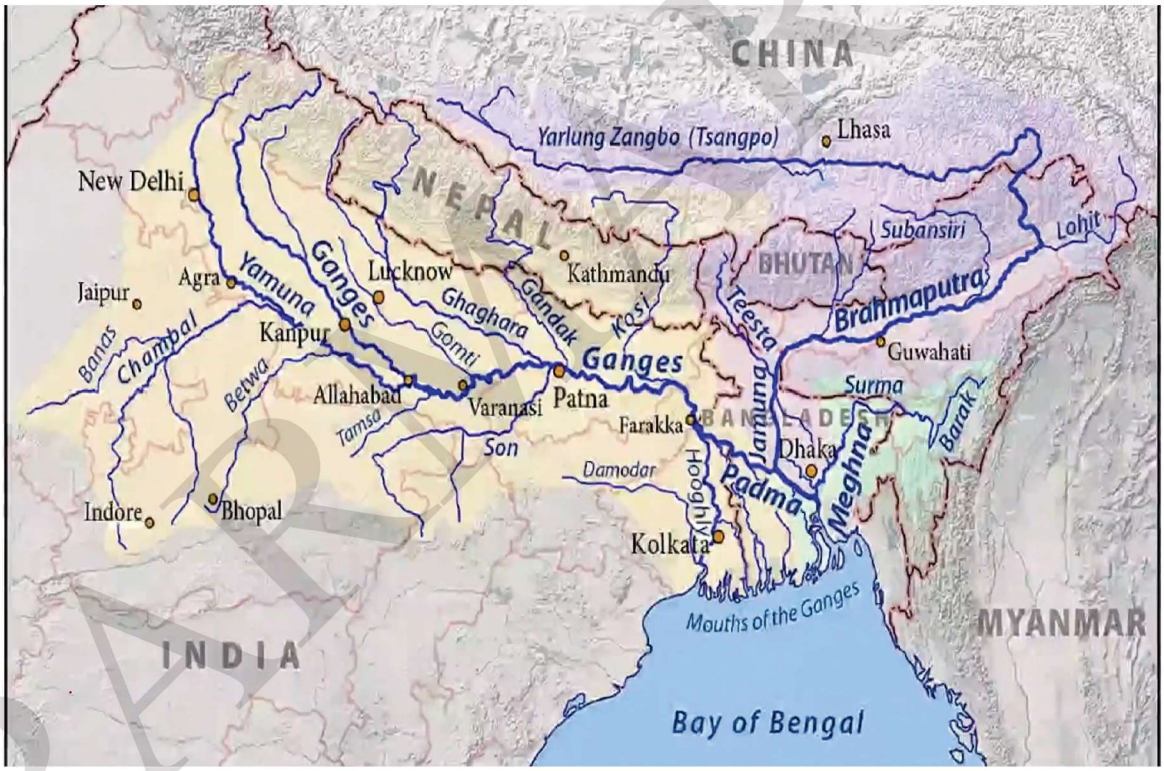
- Kosi: Sorrow of Bihar (causes flood in Bihar)

Cities located on banks of Ganga:

- Kanpur (largest)
- Prayagraj
- Varanasi
- Patna

West to East order

BRAHMAPUTRA RIVER SYSTEM



- Brahmaputra: 2900 km
- Length in India: 916 km

Different names:

- Tibet: Yarlung Tsangpo (origin)
- Siang and Dihang: Arunachal Pradesh
- Assam: Brahmaputra
- Jamuna: Bangladesh

- Takes U-turn in Namcha Barwa
- South turn in Dhubri (Assam)
- World largest Riverine Island: Majuli Island
- Origin: Chemayungdung Glacier/Angsi Glacier → Mansarovar Lake
- Padma + Jamuna = Meghna
- Barak → Manipur hills
- World's largest Delta: Sundarbans Delta (Sundari tree)

Tributaries of Brahmaputra

- **Left Bank Tributaries:** Lohit, Dhansiri
- **Right Bank Tributary:** Dibang, Kameng, Manas, Testa, Subansiri

MCQ ONE LINERS

- Drainage pattern that forms central spire or dome-like structure: Radial Pattern
- Drainage pattern forms when rivers discharge their waters from all directions in lake or depression: Centripetal
- Peninsular drainage system: Mahanadi and Godavari
- When river originates from a hill and flows in all directions, the drainage pattern formed: Radial
- River that marks easternmost boundary of Himalayas: Brahmaputra
- Snow-fed river: Yamuna (origin: Bandarpuch)
- River that is also called Vyath: Jhelum
- The river Indus was also called Hindos by the the Iranians and the Greeks
- The river Ganga divides the state Bihar into two parts
- The region of Ganga lies in: 10°N to 30°N latitude
- Yamuna rises in Indian Himalayas
- Source of river Ghaggar: Himachal Pradesh
- The headwater of Ganga: Bhagirathi
- Kolkata is in banks of Hooghly river
  - → Distributary of Ganges

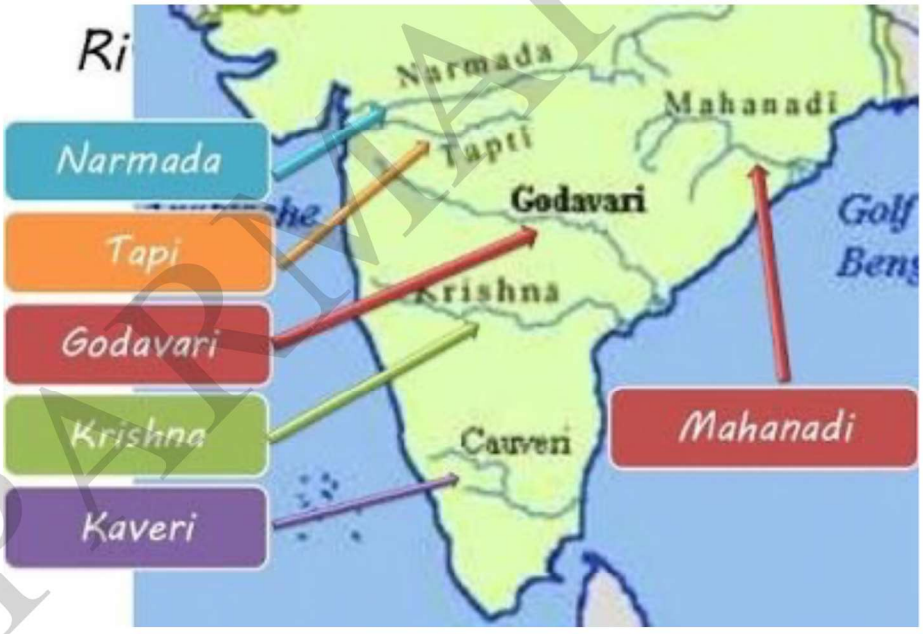
Farakka Barragr was completed in 1975 → Operational from: 1961

Also known as Ganga Water Treaty

- Farakka Agreement: Between India and Bangladesh signed on 1996

- NW1: Longest Waterway → On Bhagirathi Hoogly River Water System
  (runs from Prayagraj in UP to Haldia in WB)
- NW2: On Brahmaputra

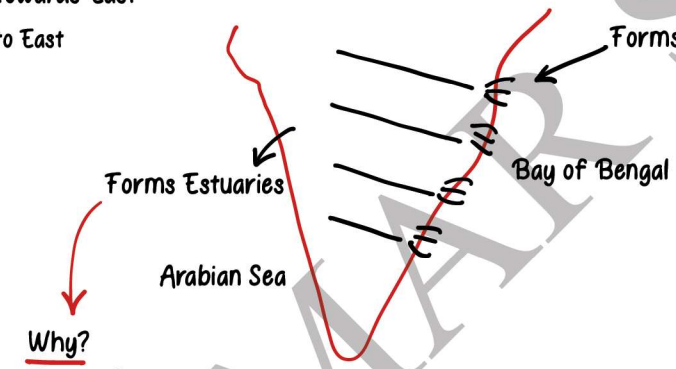
PENINSULAR RIVERS



Peninsular Rivers

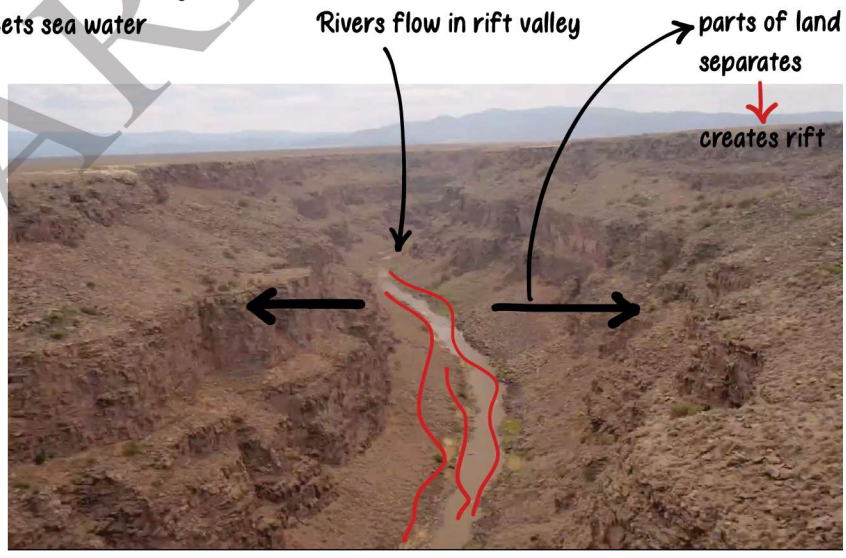
Categories:

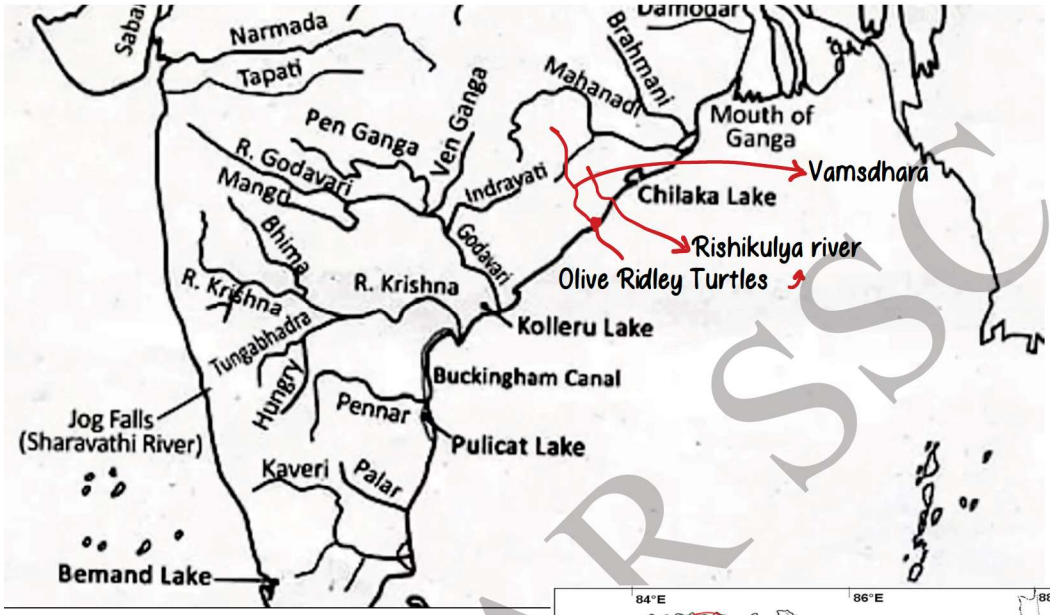
1. East flowing rivers
   - Bay of Bengal (Delta)
   - flows in East due to the tilt of Deccan Plateau
     - tilt is towards East
     - West to East
2. West flowing rivers
   - Arabian Sea/Estuary



Why?

- Narrow lanes
- Hard rocks, rivers with fresh water directly meets sea water

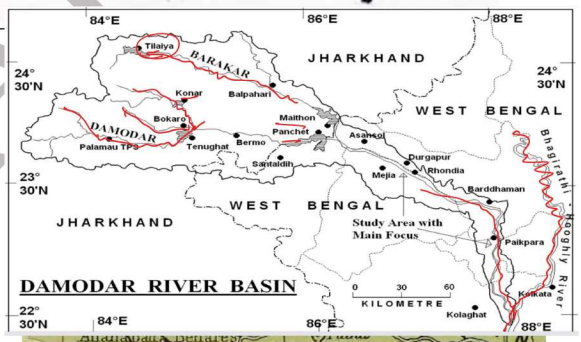




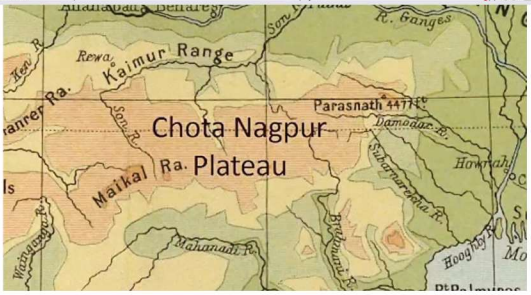
RIVERS OF ODISHA AND JHARKHAND

East Flowing Rivers

1. **Damodar**
- Chota Nagpur Plateau
- Flows in rift valley
- Tributary of Hugli → Distributary of Ganga
- Sorrow of Bengal
- Tributaries: Bokaro, Barakar, Konar



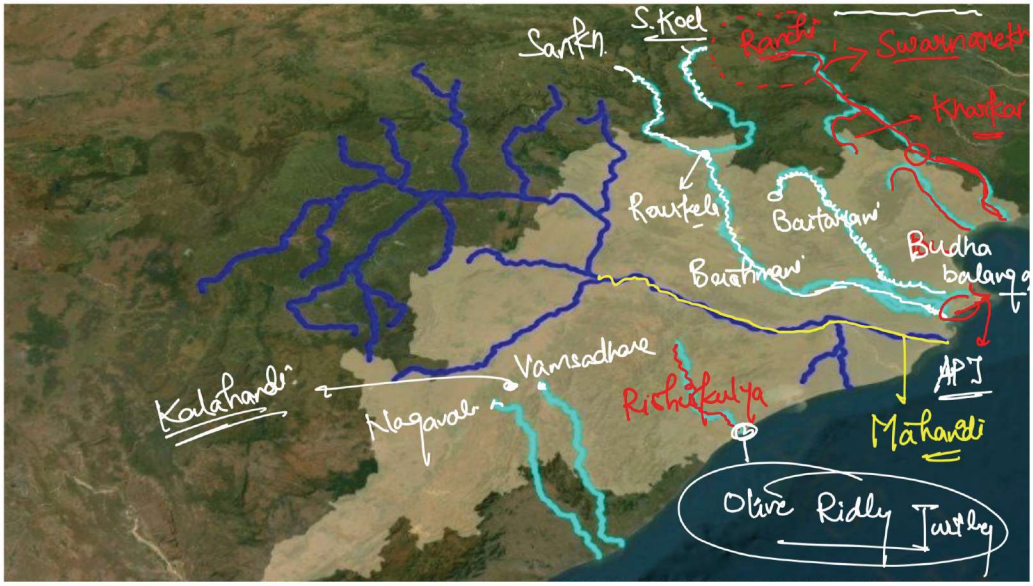
2. Subarnrekha: gold particles are seen in river
- Chota Nagpur Plateau (Ranchi Plateau)

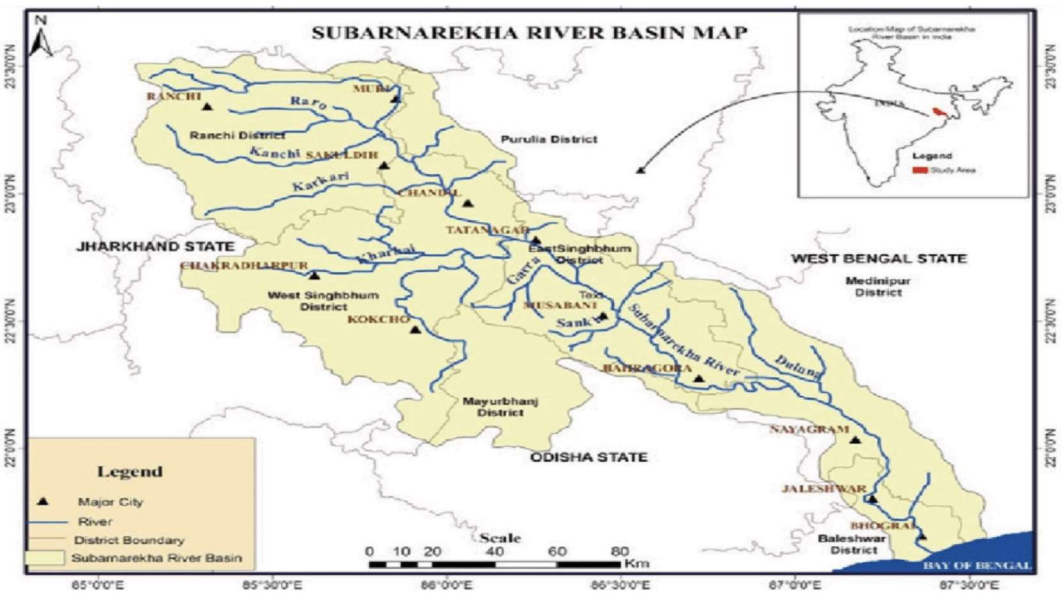


3. Baitarani & Brahmani
- South Koel + Sankha
- Mouth: APJ Abdul Kalam Islands
- Origin: Gonasikha Hills/Guptaganga Hills (Odisha)
- Delta:
  - Bhitarkanika NP/WS
  - Gahirmatha Marine Sanctuary
  } Odisha

* North Koel river is tributary of Son river

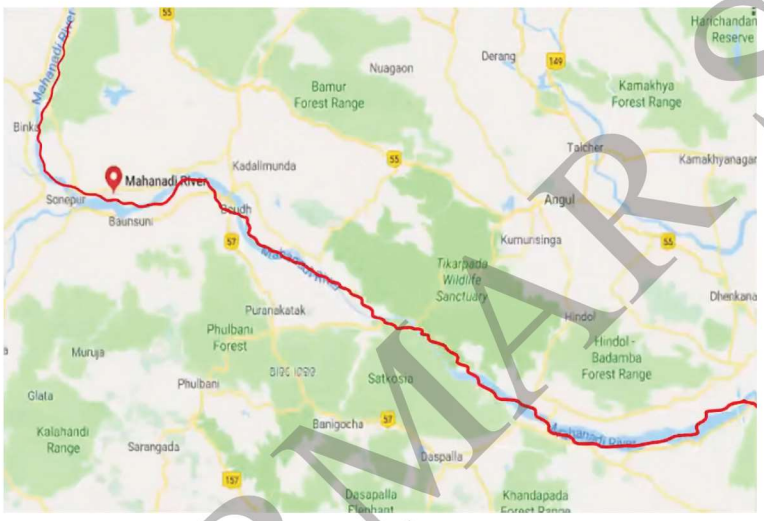
Vamsdhara: nesting ground for Olive Ridley Turtles





6. Mahanadi

- Length: 850 km
- Sorrow of Odisha
- Sihawa Hills (Rampur, Chhattisgarh)
- Flows mainly in Chhattisgarh + Odisha (River basin spread across Jharkhand, Maharashtra , Madhya Pradesh)
- Dam built on this river: Hirakud Dam
- Tributaries: Tel, Jonk, Ong, Hasdeo, and Mand



7. Godavari

- Length: 1465 km
- Origin: Trimbakeshwar Plateau (Nasik, Maharashtra) — from Sahyadri, Western Ghats
- Maharashtra → Telangana → Andhra Pradesh → Forms delta
- Rivers basin spread across: Chhattisgarh, Odisha, Madhya Pradesh, Karnataka
- Largest river of South India, Called as Dakshin Ganga
- Tributaries
  - M: Manjira
  - S: Sabri
  - W: Wainganga
  - W: Wardha
  - I: Indravati
  - P: Painganga
  - P: Purna
  - P: Pranhita

8. Krishna
- Length: 1400 Km → Source: Sahyadri range
- Origin: Mahabaleshwar
- Maharashtra → Karnataka → Telangana → Andhra Pradesh → Delta
- Second longest river of South India
- Tributaries: Bhima, Tungabhadra, Ghataprabha, Malaprabha, Musi, Konya, Dhoodhganga

→ TRICK

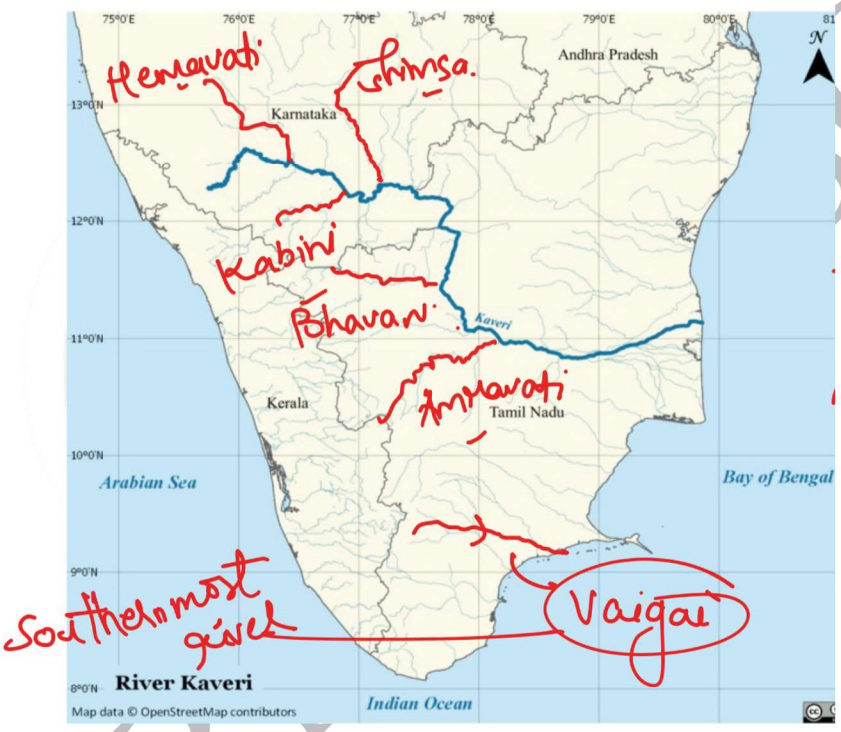
भीम तू मौसी को घाट धूध की माला

9. Pennar → Other name: Pinakini
- Origin: Karnataka (Chikkaballapura) → Nandi Hills
- Independent flowing river of Andhra Pradesh

10. Kaveri
- Length: 800 km
- Origin: Brahamgiri Hills (Karnataka, Kodagu district)
- Karnataka → Tamil Nadu → Delta
- Only river of south India which flows throughout the year → Perennial river

Flow is like Ganga and tributaries resembles Ganga

- It is called Ganga of South India
- Tributaries: Hemvati, Kabini, Bhavani, Shimsha
- Delta: known as Garden of South India



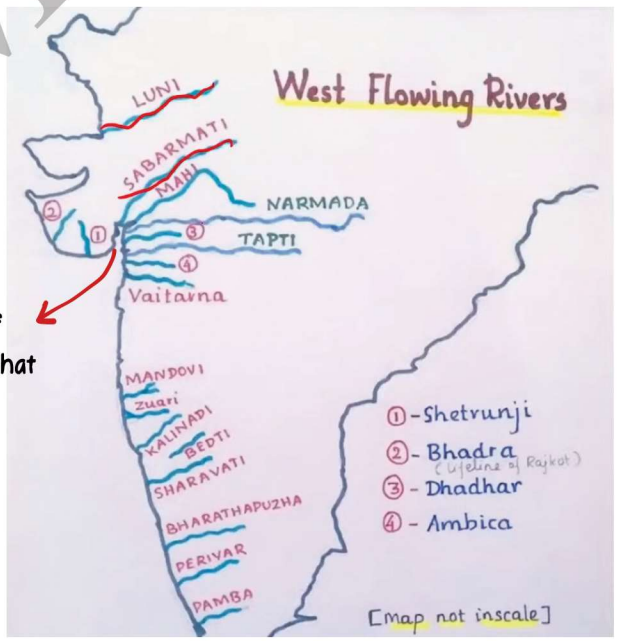
10. Vaigai: Southern-most river of India

→ West Flowing River

Flows into Arabian Sea

1. Luni River
2. Sabarmati
3. Mahi
4. Narmada
5. Tapti

Gulf of Khambhat



1. Luni River → Also known as Lavanavari or Lavanavati river

- Origin: Nag Hills, Rajasthan
- Flows through: Rajasthan → Gujarat
- Only river that contains saline water
- It doesn't reach up to oceans and ends in Rann of Katchh

Endorheic river (flows into inland basins and salt lakes meaning water never reaches the sea)

2. Sabarmati

- Origin: Aravalli mountains (Udaipur, Rajasthan)
- Flows through: Rajasthan → Gujarat
- Gandhinagar and Ahmedabad are located on its bank

3. Mahi

- Origin: Vindhya mountains
- Flows through: Madhya Pradesh → Rajasthan → Gujarat → Gulf of Khambhat
- This crosses Tropic of Cancer two times

4. Narmada → Dhuandhara falls, Kapildhara falls located on this river

- Length: 1312 km
- Longest Western River flowing into Arabian Sea
- Origin: Amarkantak Plateau, Madhya Pradesh
- Flows through: Madhya Pradesh → Maharashtra → Gujarat → Gulf of Khambhat
- Flows in rift valley, flows b/w Vindhya and Satpura
- Jabalpur is located on its bank
- Tributaries: Banjar, Tawa, Shakkar, Halon

5. Tapti

- Length: 724 km
- Origin: Betul Plateau, near Amarkantak Plateau (Madhya Pradesh) → Multai hills
- Surat is located on its bank
- Tributaries: Aner, Gomai, Girna, Purna, Bori, Girna, Arunawati
- Madhya Pradesh → Maharashtra → Gujarat
- This river flows through a rift valley in Central India

→ Goa

Rivers:

- Zuari → Estuary: Mormugao
- Mandovi known as Lifeline of Goa, Panji is located on its bank

→ Kerala

Rivers:

- Bharatphuza (Another name: Ponnani)
- Periyar known as life line of Kerala, Longest river of Kerala
- Pamba drains into Vembanad lake

→ Karnataka

Rivers:

- Kalinadi and Sharavati, Varahi
  - ↓ Jog falls
  - ↓ Kunchikal waterfalls (highest waterfalls)

ONE LINERS

- Source of river of Ghaggar: Himachal Pradesh
- Kaveri is known as "Pooni" in Tamil, fourth largest river flowing in Southeast direction through Karnataka and Tamil Nadu
- Does not drain into Bay of Bengal: Indus
- Headwater of river Ganga: Bhagirathi
- Allahabad: located on the confluence of river Yamuna and Ganga
- Decommissioned Havelock bridge built over: Godavari
- State that has largest catchment area of Godavari Basin: Maharashtra
- River that cover an area of 65,145 km^2 of which 80% lies in Maharashtra: Godavari

- Mahanadi basin doesn't extend to: Uttar Pradesh
- Second longest river of India that covers 10% of the country's area: Godavari
- River basin in Odisha: Mahanadi
- Sundarban Delta is created by Ganga–Brahmaputra rivers
- Tapti empties in Gulf of Cambay of the Arabian Sea, in state of Gujarat
- City not located on banks of river Ganga: Hazaribagh
- Cities that does not lie on the path of river Ganga: Lucknow
- Gandak river comprises of two rivers: Kaligandak and Trishulganga
- Wang Chu river is tributary of Brahmaputra and flows through Bhutan
- Branch of Godavari that joins Bay of Bengal flowing through Yanam enclave of the Union territory of Pondicherry: Gautami
- Mouth of Indus River lies to the north of the Tropic of Cancer
- Only large river in the Indian Desert: Luni River
- Ghagra rises in Nepal Himalayas
- The largest Amazon river, is the 2nd longest river in the world, with a length of 6,400 km is located in the northern part of South America

Flows through Venezuela, Brazil, Peru, Bolivia, Ecuador, Guyana, Suriname

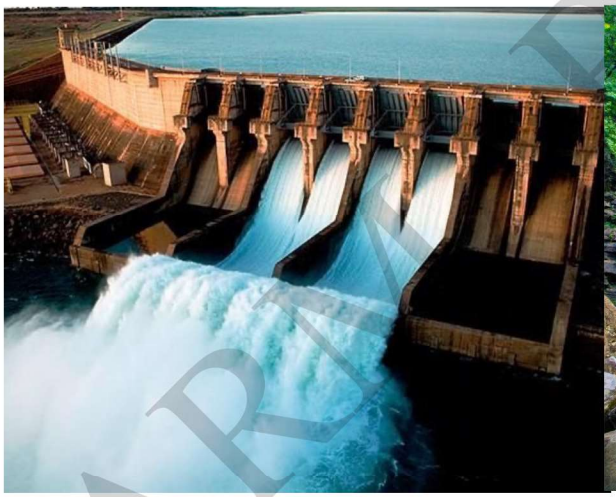
- Longest river of the world: Nile called as Boon of Egypt
- The city of Sanghai is located at the mouth of the Yangtze River

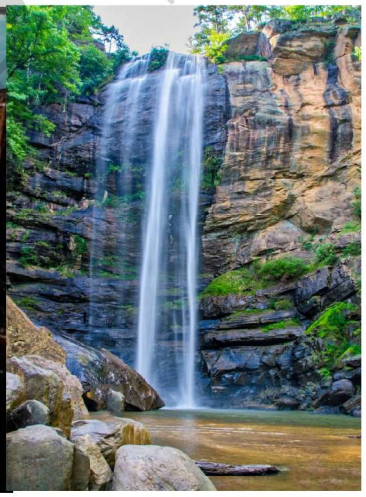
Only river that flows through one country

World's 3rd longest river

- River that cuts Tropic of Capricorn twice: Limpopo river
- River that cuts Equator twice: Congo river
- Gharials are seen in Chambal River
- Rank on the basis of Basin/Water discharge:
  1. Amazon
  2. Congo
  3. Ganga → Dolphins are found here
- Great rift valley is in Africa

DAMS, LAKES, WATERFALLS





Hydroelectric Power Projects

- **Multipurpose Project**

Purpose: Flood control, hydropower generation, irrigation, tourism

- M.E = P.E + K.E

Negative/Drawbacks

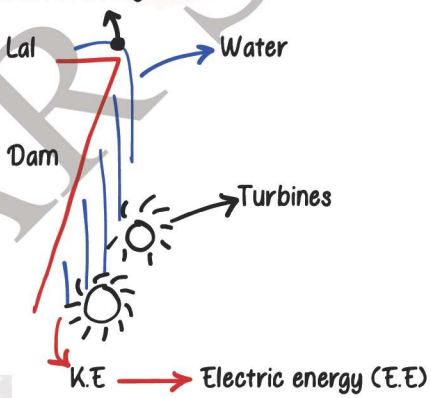
- Displace large no. of tribals/peasants
- Create environment problems like biodiversity loss

- **Potential Energy (P.E):** P.E is the energy that is stored in an object in an object due to its position relative to some zero position

- **Kinetic Energy (K.E):** form of energy that shows an object or a particle has by reasoning of its motion

Water when stored gains P.E

- Mentioned as "Temple of Modern India" by Jawahar Lal Nehru



Important/Major Dams

1. **Damodar Valley Project**

India's first river valley project (1948)
It is based on the Tennessee River of USA
There are 8 dams built on Damador and its tributaries

Maithon	Jharkhand	Borakar River
Tilaiyah	Jharkhand	Borakar River
Panchet	Jharkhand	Damodar
Konar	Jharkahnd	Konar

- Another type of Dam: Earthen Dam

2. **Bhakra Nangal Project**

- Constructed during First Five Year Plan
- Built on Sutlej river

→ Consists of two dams:

- Bhakra: Himachal Pradesh (Gobind Sagar Lake from Bhakra Nangal Dam)
- Nangal: Punjab
- Highest Gravity Dam → bears forces on its own
- Largest Dam of India in terms of area

3. Hirakud Dam
- In Odisha, Sambalpur district
- Built on Mahanadi river
- Longest dam of world/India (4.8 km/25.8 km)

4. Tehri Dam
- In Uttarakhand
- Built on Bhagirathi river
- Highest Dam of India (261 m)

Sunderlal Bahuguna
↓
Chipko Movement against deforestation
Anti-Tehri Movement

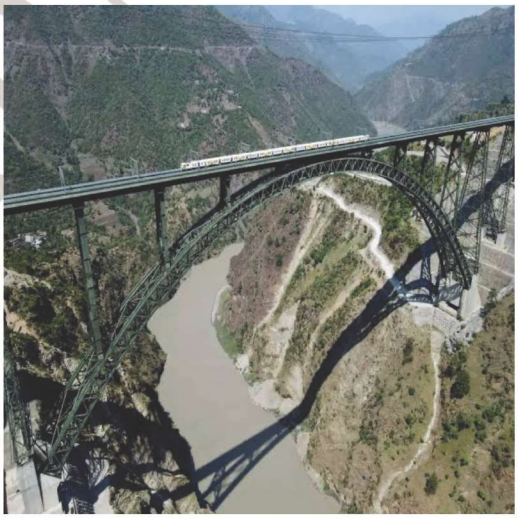
5. Farakka Dam
- In West Bengal, built on Ganga river
- This dam was built to provide water to the Hooghly river

State-wise

Jammu and Kashmir
- Dulhasti Hydroelectric Project
- Baglihar Hydroelectric Power Project
- Salal Hydroelectric Power Station

} All on Chenab river

↓
Highest railway bridge (Chenab rail bridge) is constructed on Chenab river near Salal Hydroelectric Project
↳ Height: 359 m high (1,178 ft)



CHENAB RAIL BRIDGE

- Kishan Ganga
- Tulbul
- Uri

All on Jhelum river

Himachal Pradesh

- Pong Dam (Maharana Pratap Sagar): Beas river
- Chamera Dam: Ravi river
- Nathpa Jhakri: Sutlej
- Baira Siul Dam (Chamba district): Ravi river
- Bassi Dam: Ravi river

Uttar Pradesh

- Matatila Dam
- Lakshmibai Dam

Betwa river

- Rihand Dam: Rihand river (Govind Ballabh Pant Sagar Reservoir)
  - Largest artificial lake of India
  - Built on Rihand river (tributary of Son)

Gujarat

- Ukai Dam: Tapi river
- Kakrapar Dam: Tapi river
- Sardar Sarovar Dam: Narmada river
- Kandana Dam: Mahi river

Punjab

- Thein dam (also known as Ranjit Sagar Dam)
- Shahpur Kandi Dam

Ravi river

- Harike Dam: On Sutlej and Beas confluence
  - Indira Gandhi Canal developed on it

Madhya Pradesh

- Tawa Dam: Tawa river (tributary of Narmada)
- Ban Sagar Dam: Son river
- Omkareshwar Dam: Narmada river
- Indira Sagar Dam: Narmada river
- Gandhi Sagar Dam: Chambal river

Rajasthan

- Mahi Bajaj Sagar Dam: Mahi river
- Bisalpur Dam: Banas river → Is in Rawatbhata
- Rana Pratap Sagar Dam: Chambal river
- Jawahar Sagar Dam (on Chambal river)

Maharashtra → State with maximum number of large dams in the country

- Jayakwadi Dam: Godavari river
- Dhom Dam: Krishna
- Koyna Dam (largest dam of Maharashtra): Koyna river
- Isapur Dam: Penganga river
- Ujjaini Dam: Krishna river

Jharkhand

- Panchet Dam: Damodar river
- Maithon + Tilaiyah: Barakar
- Konar dam: Konar

Chhattisgarh

- Indravati Dam: Godavari river

Hasdeo Dam: Hasdeo river (largest tributary of Mahanadi)

Karnataka

- Jog/Mahatma Gandhi Dam: Sharavati river
- Linganamakki Dam: Sharavati river
- Shivsamudram Dam: Kaveri river
- Almatti Dam: Krishna river
- Krishnaraja Sagar Dam: Kaveri

Kerala

- Periyar/Mullaperiyar/Idukki Dam: Periyar (life line of Kerala)

Telangana

- Pochampad (Sriram Sagar) Kaleshwaram Lift Irrigation Project : Godavari river
- Nizam Sagar Dam: Majira river
- Nagarjuna Sagar Dam: Krishna river

Tamil Nadu

- Pykara Dam: Pykara river
- Mettur Dam: Kaveri river

Andhra Pradesh

- Srisailam Dam | Krishna river
- Nagarjuna Sagar Dam
- Somasila Dam: Pennar/Penna river (Nellore district)

Types of Waterfall

- **Cataract Waterfall:** A large, powerful waterfall that occurs when a large amount of fast moving waterfalls over a cliff (large volume of water)
- **Plunge Waterfall:** a waterfall where water falls straightly down without touching the cliff face below (water velocity high)
- **Cascade Waterfall:** A waterfall that consist of series of small falls where water flows over rocks or boulders (multi-step waterfall)

Some Important Waterfalls of India

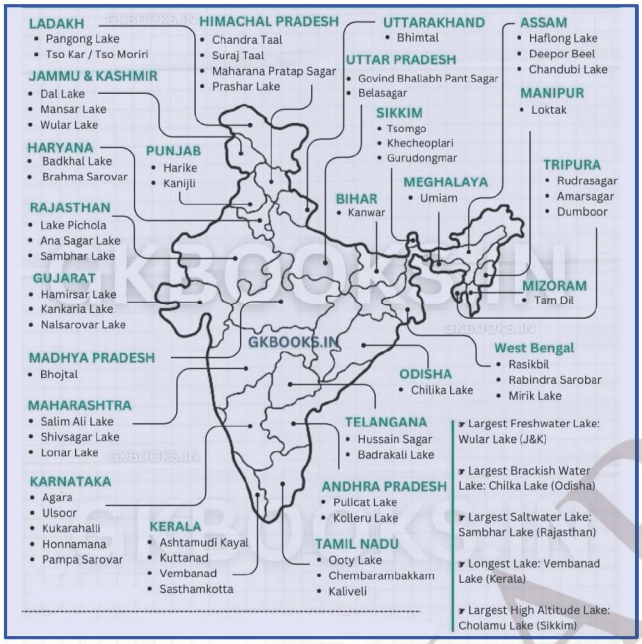
Name	River	State
Kunchikal (highest waterfall: 455 m)	Varahi	Karnataka (Shimoga)
Jog/Gersoppa/Mahatma Gandhi (2nd highest waterfall in India)	Sharavati	Karnataka
Shivsamundram	Kaveri	Karnataka
Chulia	Chambal	Rajasthan
Dhuandhar Kapildhara	Narmada	Madhya Pradesh
Hundru	Subarnarekha	Jharkhand
Dudh Sagar	Mandvi	Goa

- **Highest waterfall in the world:** Angel waterfall in Venezuela
- **2nd highest in the world:** Niagara Falls (in USA-Canada border)
- **Niagara Falls of India:** Chitrakoot waterfall in Chhattisgarh

Some more Waterfalls

- Barehipani waterfalls } Odisha
- Khandadhar waterfalls }
- Athirappilly waterfalls: Kerala
- Duduma waterfalls: Odisha (Koraput)
- Gokak waterfalls: Karnataka (Ghataprabha)
- Nohkalikai falls: Meghalaya
- Hebbe waterfalls: Karnataka

Lakes of India (state-wise)



Jammu & Kashmir
- Wular lake: Largest freshwater lake in India, it is also formed as a result of tectonic activity
- Anchar lake
- Mansar lake
- Dal lake (Jewel of Srinagar)
- Manasbai lake

Ladakh
- Pangong Tso lake → In Aksai Chin border
- Lake Tso kar
- Lake Tso Moriri
- Aksai Chin Lake

(Lake Tso kar, Lake Tso Moriri, Aksai Chin Lake: Salt water lakes)

Uttarakhand
- Dodital lake
- Bhimtal lake
- Roop Kund lake
- Nainital lake
- Suryadhar lake

Rajasthan
- Pushkar lake (in Ajmer)
- Sambhar lake: Largest inland saltwater lake (salinity more than Chilika but area less than Chilika (Odisha))
- Jaisamand/Dhebar lake: 2nd largest artificial lake in Asia (Udaipur)

Bihar
- Kanwar Tal: Largest Ox-bow lake (Ramsar site in 2022)
- Gogabill lake

Uttar Pradesh
- Keetham lake/Sur Sarovar(Agra): it is a man-made reservoir added to Ramsar site in year 2020
- Gobind Vallabh Pant Sagar: largest artificial lake of India (Sonbhadra district)

Gujarat
- Nalsarovar lake
- Rann of Kutch lake
- Thol lake: Ramsar site in 2021

Himachal Pradesh
- Govind Sagar lake
- Renuka lake

Madhya Pradesh
- Bhojtal/Bhopal lake: Was formally known as Upper lake → Asia's largest artificial lake
  - Constructed by Raja Bhoj (Parmar Dynasty's most famous and powerful ruler, who also established Bhopal city)

Haryana
- Surajkund lake

Maharashtra

- Bhushi lake
- Lonar lake: Also called crater lake (created due to meteorite) → Buldhana district

Kerala

- Vembanad lake: Longest lake of India (Pamba river falls on it)
- Sasthamcotta lake
- Ashtamudi lake

Tamil Nadu

- Pulicat lake: Between Andhra Pradesh and Tamil Nadu (India's 2nd largest brackish water lake)
- Kaliveli lake

Telangana

- Srisailam lake
- Nagarjuna Sagar lake
- Hussain Sagar lake: Connects Hyderabad & Secunderabad
- Nizam Sagar lake

Sikkim

- Tso Lhamo lake/Cholamu lake: Highest lake in India
- Tsomgo Chho lake

Andhra Pradesh

- Pulicat lake (between Andra and Tamil Nadu)
- Kolleru lake

Odisha

- Anshupa Lake
- Chilika Lake: Largest brackish water lake (freshwater + salt water)
  - → 1st Ramsar site

Assam

- Haflong lake
- Chandubi lake
- Deepor Beel lake

Meghalaya

- Barapani/Umiam lake: Shillong

Manipur

- Loktak lake: It is famous for phumdis floating over it
  - → World's only floating lake
  - Keibul Lamjao National Park: World's only floating NP

Lakes of the World

Africa

- Lake Victoria (White Nile originates from here) → Is in three countries: Kenya, Tanzania, Uganda
- Lake Tana (Blue Nile originates from here)

South America

- Lake Titicaca (highest navigable lake in the world)

Canada → Has the most natural lakes in the world

- H: Lake Huron
- O: Lake Ontario
- M: Moraine lake
- E: Lake Erie
- S: Lake Superior (world's largest freshwater lake)

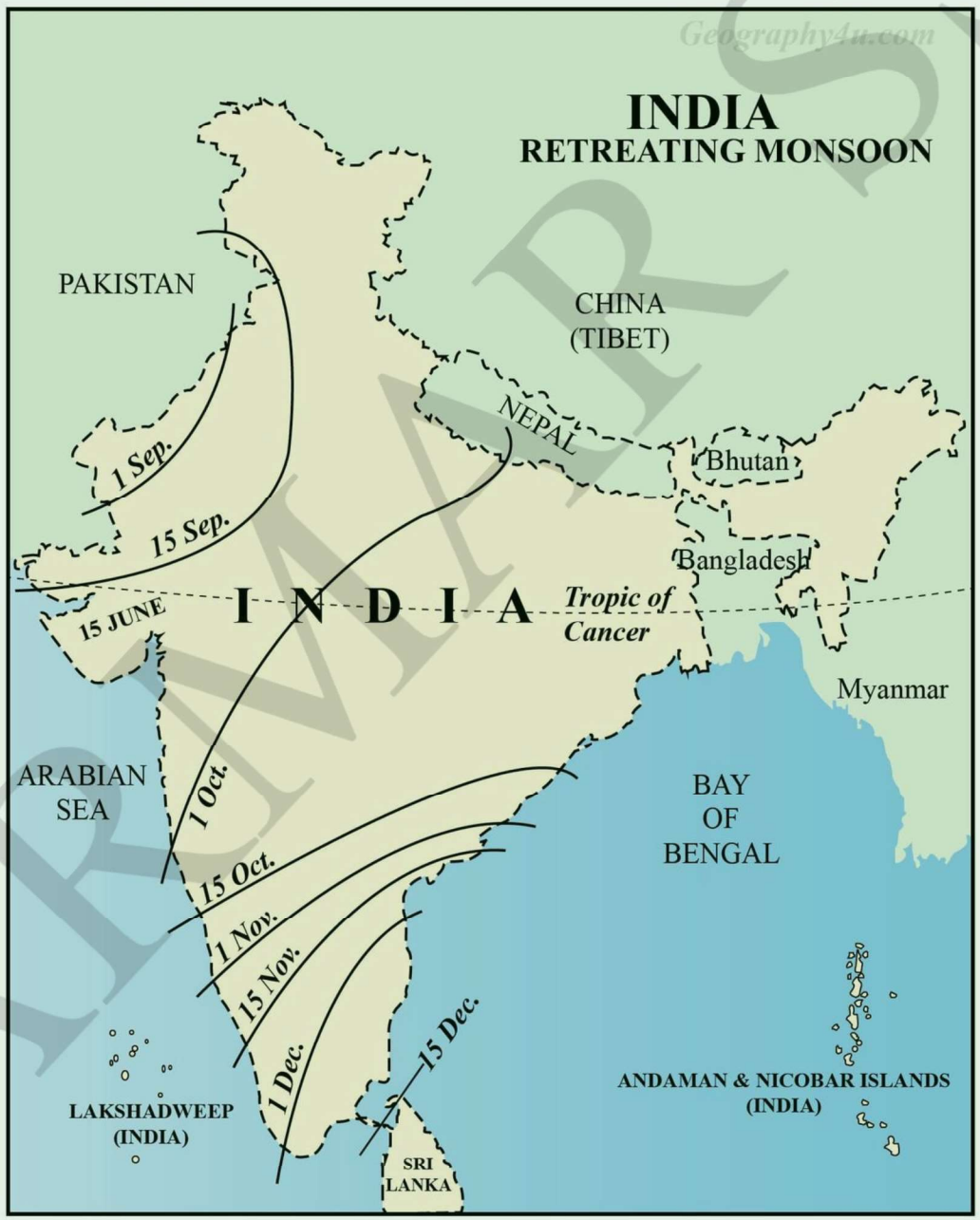
- Caspian Sea: Sorrounds fiver countries → Russia, Iran, Azerbaijan, Turkmenistan, Kazakhstan

Russia

- Lake Baikal: Deepest lake of the world

- Black Sea: Bordered by Ukraine, Russia, Georgia, Turkiye, Bulgaria, Romania

MONSOON



INDIA: RETREATING MONSOON

- **Factors affecting climate of India**
  1. Latitude
  2. Altitude
  3. Pressure and wind system
  4. Relief features
  5. Ocean Currents
  6. Distance from Sea

- **Climate**: the average weather in a given area over a longer period of time. Data taken of 30 years

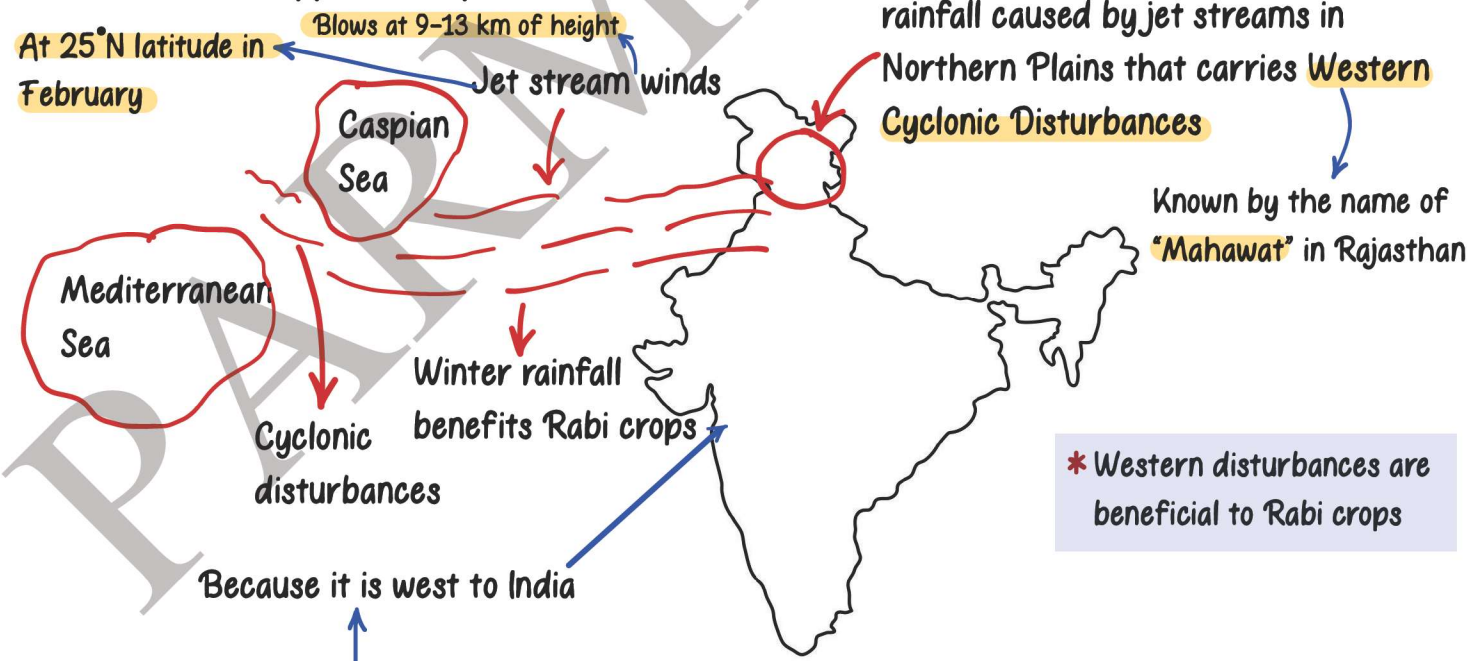
- **Weather**: the term refers to temporary conditions of the atmosphere, including temperature, atmospheric pressure, wind, humidity, precipitation, and cloud cover

Winter Season

Chilling winds from Arctic/Central Asia affects winter season, but they are blocked to a certain extent by the Himalayas

Winter Rainfall

It is known as Upper atmospheric Circulation



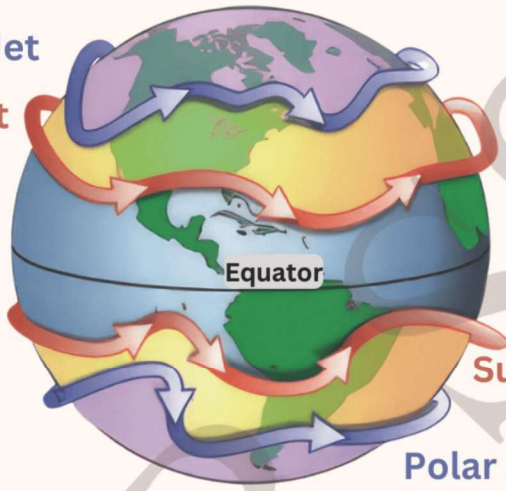
Inward of Western Disturbances through jet streams is marked by increase in prevailing night temperature

In upper troposphere (9–13 km) very high speed of winds

Polar Jet

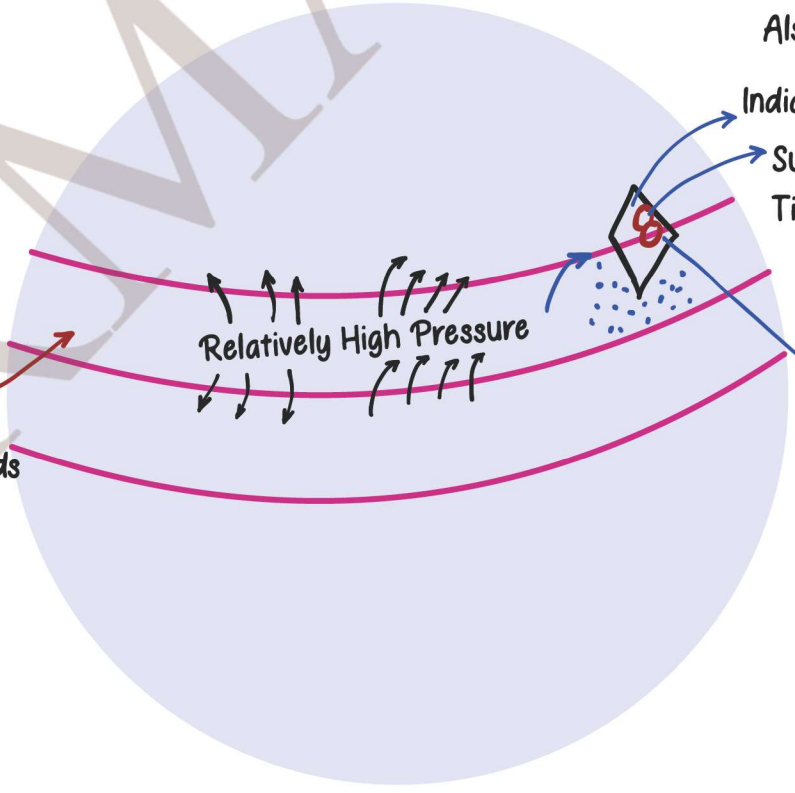
Subtropical Jet

Jet streams shift north and south as they follow boundaries of hot and cold air.



In both hemispheres, jet streams blow west to east.

Summer Season



Also in Indian Peninsula

India

Summer rays over Tibetan plateau

Intense heating

Creates low pressure

ITCZ now shifts in upper region

- Trade winds meet and air ascends
- During July: 20°–25°N

Pre-Monsoon Showers

Nor-Westers

- Kal Baisakhi
  - Calamity in the month of Baisakh in West Bengal
  - helpful for growth of jute, tea
- Bardoli Chheerha
  - In Assam

Blossom Showers

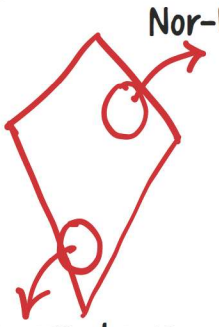
Seen in Kerala/ Karnataka

Helps in growth/cultivation of coffee

Mango Showers

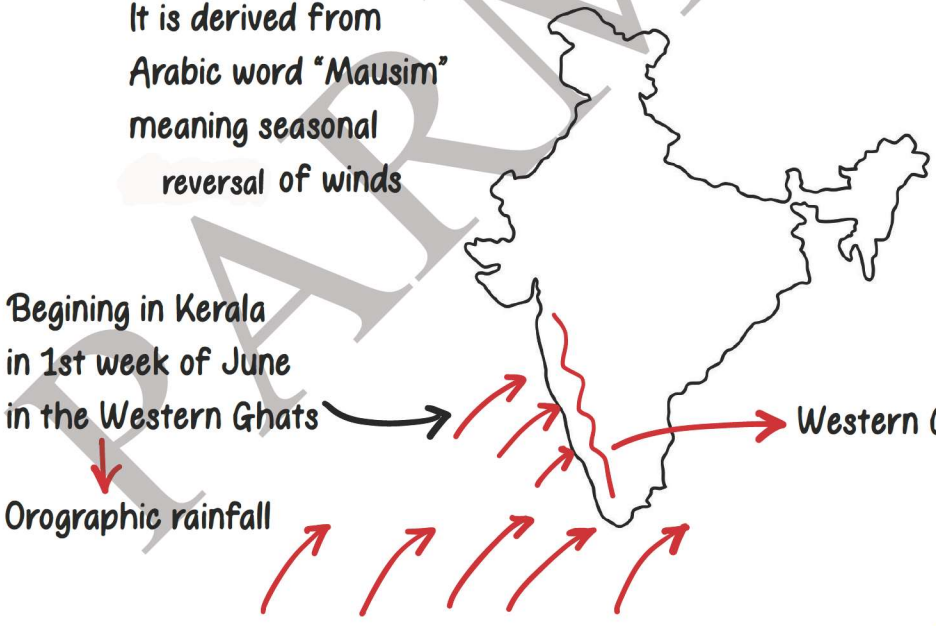
Seen in Kerala

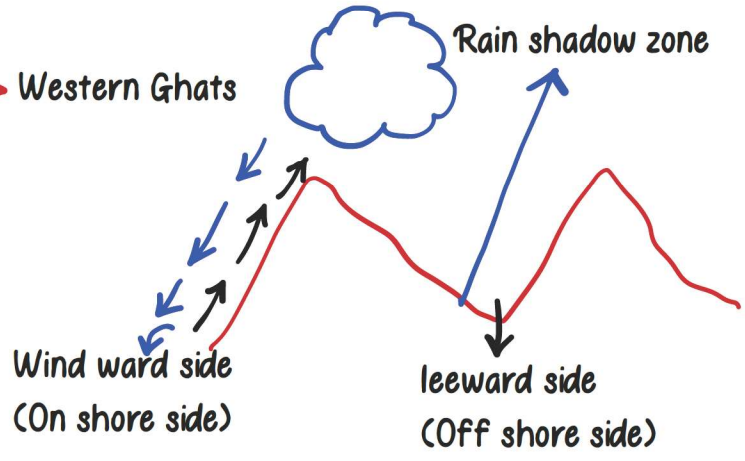
Helps in early ripening of mangoes



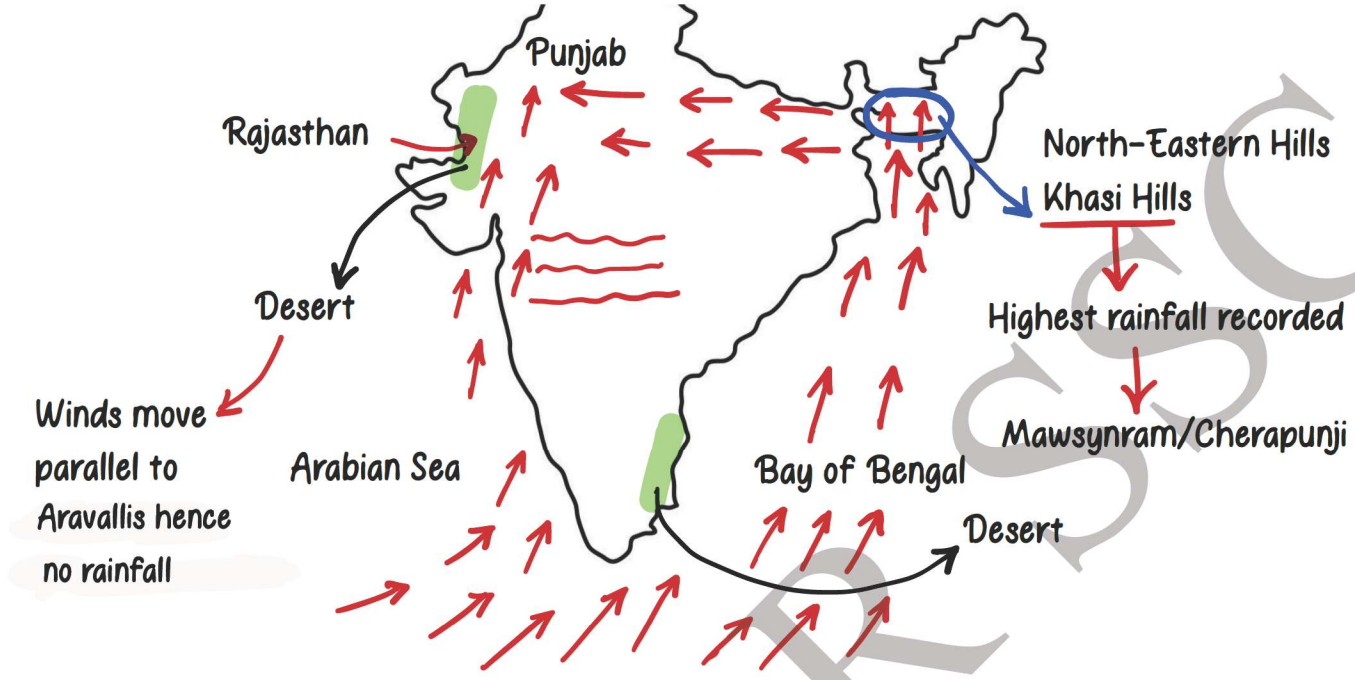
• On Set of Monsoon

It is derived from Arabic word "Mausim" meaning seasonal reversal of winds





Rain Bearing System



- Bay of Bengal branch and Arabian Sea branch of South West Monsoon meet at Punjab

Break in Monsoon

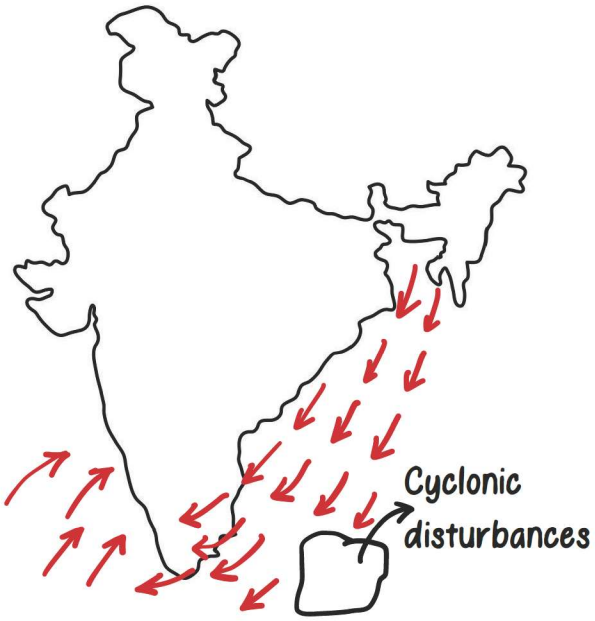
↓

Sudden decrease in rainfall after the onset of monsoon

Retreating monsoon

↓

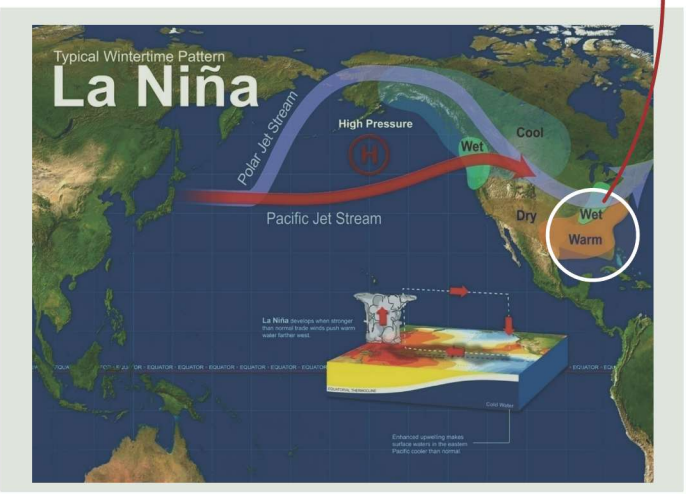
Also known as North-East Monsoon and it causes rainfall over Coromandel coast (Tamil Nadu/Andhra)



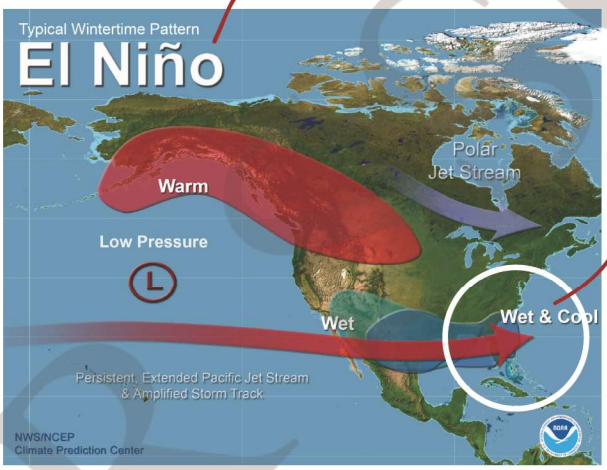
In North India

- Clear skies
- October heat: oppressing heat

Warm current



Adversely affects the monsoon



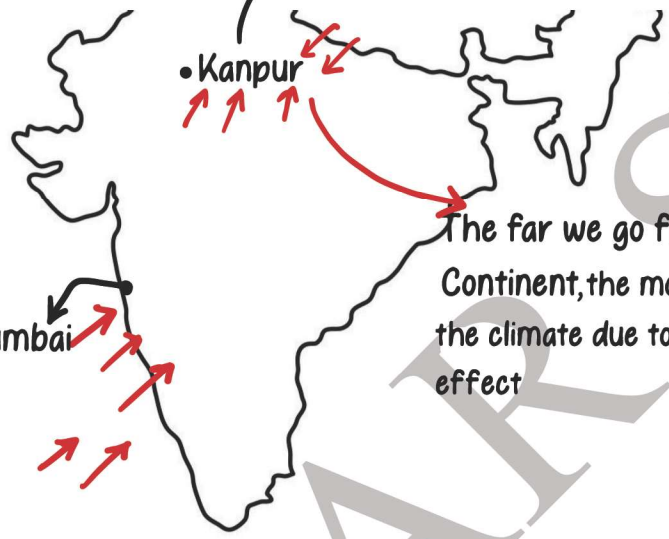
North East winds weakens thus water returns

La Nina	El Nino
Meaning: Small girl	Meaning: Child Christ/Small boy
Below average sea surface temperature in east-central equatorial Pacific (cold phase on ENSO cycle)	Above average sea temperatures in east-central equatorial Pacific (warm phase of ENSO cycle)
Trade winds strengthen, pushing warm water westward	Trade winds weaken, allowing warm water to spread eastwards
Seen every: 2-7 yrs	Seen every: 3-7 yrs
Leads to cooler global temperatures	Leads to warmer global temperatures
It can cause intense rainfall in Australia and India along with heavy floods; drier conditions in South America	It can cause droughts in Asia and Australia and in the US, El Nino has its strongest impact during winter
Fishing industries will flourish	Fishing industries won't flourish

Variation in Temperature/Rainfall

1. Diurnal Range of Temperature: Daily range of temperature
2. Annual Range of Temperature
3. Annual Range of Rainfall

More in the interior of Continents and less in the the coastal cities

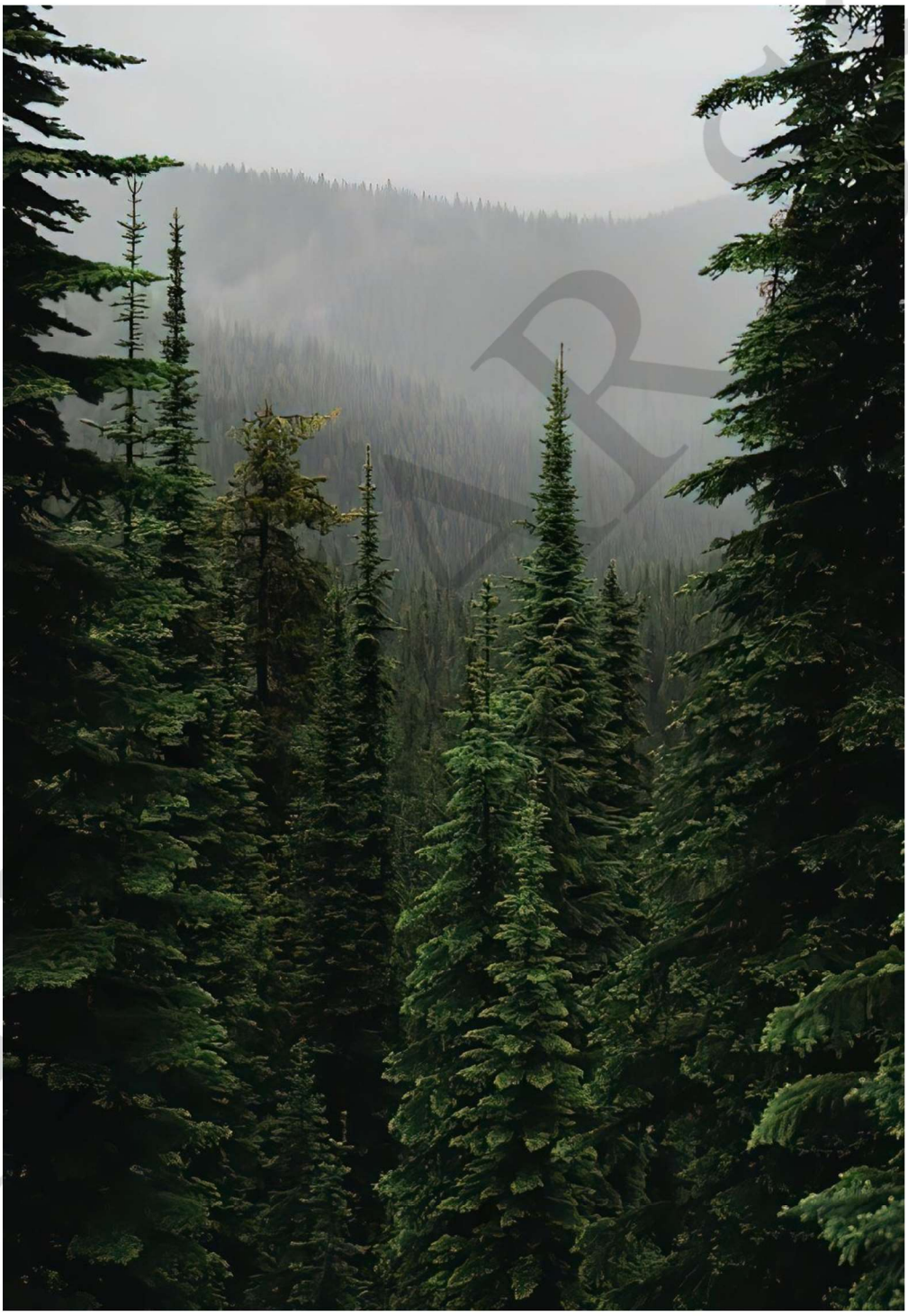


Coastal cities do not experience extreme climate due to "moderating influence of sea"

Seasons and Months

Seasons	Months (According to the Indian Calendar)	Months (According to the Indian Calendar)
Vasanta	Chaitra-Vaisakha	March-April
Grishma	Jyaistha-Asadha	May-June
Varsha	Sravana-Bhadra	July-August
Sharada	Asvina-Kartika	September-October
Hemanta	Margashirsa-Pausa	November-December
Shishira	Magha-Phalguna	January-February

FORESTS AND GRASSLANDS



Forest

Evergreen Forests

- They are layered forests (due to different stratas present in the forest)
- Stratas in Evergreen forest
  Top vertical: Trees
  Middle vertical: Shrubs
  Bottom: Herbs and Bushes
- They appear green all year because the trees in these forest don't shed their leaves at the same time
- They are seen in places of high-temperature → (above 22°C) and high rainfall (200 cm)
- In India, seen in western side of Western Ghats, Andaman and Nicobar Islands, North-East, Tamil Nadu coast (heavy rainfall in these areas)
- Highest biodiversity is seen here
- Vegetation seen: Ebony (epiphytes), mahogany, rosewood, rubber, and cinchona

Deciduous Forests

Foothills of Himalayas

- They are spread over a region, receiving rainfall between 200 cm and 70 cm
- These are most widespread forest of India (called Monsoon forest)
- Divided into
  Moist deciduous
  Dry deciduous
  } On basis of availability of water

* Tendu leaves are used to make Bidi
* Guttation: Hydathodes

MOIST DECIDUOUS	DRY DECIDUOUS
Found in: Areas receiving rainfall 200-100 cm	Found in: Areas receiving rainfall 100-70 cm
Mostly in eastern part: Northeastern states, foothills of Himalayas, Jharkhand, West, Odisha, and Chhattisgarh and on eastern slopes of Western Ghats	Mostly in: rainier part of Peninsular Plateau and plains of Bihar and Uttar Pradesh
Example: Teak (most dominant), bamboos, sal, shisham, sandalwood, khair, kusum, arjun, and mulberry	Example: Teak, sal, peepal, neem, tendu, palas, amaltas, bel, khair, axlewood
	On the wetter margins, it has a transition to the moist deciduous, while on the drier margins to thorn forests

Thorn Forests

- **Found in:** Regions with <70cm of rainfall
- Thorns are modified form of leaves (to avoid water loss)
- **Vegetation seen in:** Northwestern part of country (semi-arid areas) of Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Uttar Pradesh, and Haryana
- **Main plant species:** Acacias, palms, euphorbias, cacti
- Special type of grass seen here: Tussocky grass (height upto: 2m)
- Trees are scattered with long roots penetrating deep inside soil

Coniferous Forests

- Shape: Cone
- Seen in areas of high snowfall
- **In India:** Seen in upper Himalayas
- **Trees:** Softwood trees → such as Chir, pine, cedar, deodar, spruce (Gymnosperms)

Montane Forests

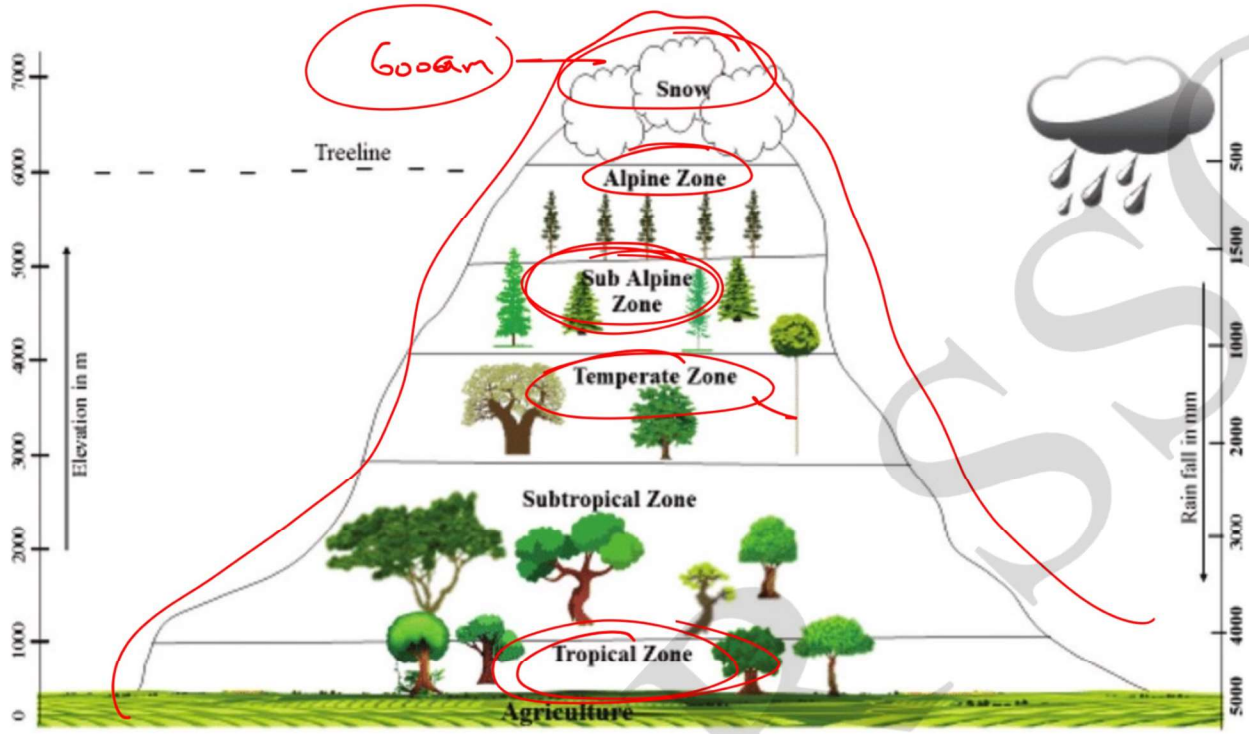
In mountainous areas

- Decrease in temperature with increase in altitude → Corresponding change in natural vegetation
- There is succession of natural vegetation belts in same order as we see from Tropical to Tundra region

Succession with Changing Altitude

- **Foothills of Himalayas:** Deciduous forests
- **1000–2000 m:** Wet Temperate Forests; Evergreen Broad Leaf Trees (Oaks, Chestnuts)
- **1500–3000 m:** Temperate Forests containing Coniferous trees (pine, deodar, silver fir, spruce, and cedar)
- **Above 3600 m:** Temperate Forests and grasslands → Alpine vegetation (silver fir, junipers, pines, rhododendrons, and birches)
- **Shrubs + Scrubs:** Alpine grasslands (Bugyal)
- **At higher altitudes:** Mosses + Lichens (Tundra vegetation)

* Montane Forests are extensively used for grazing by **nomadic tribes** (Gujjars and Bakarwals)



Southern Montane Forests

- Found in three distinct areas of Peninsular India: Western Ghats, Vindhyas, Nilgiris
- Closer to tropics → Only 1500 m above the sea level

Vegetation

- Temperate: In higher regions
- Subtropical: On lower regions of Western Ghats (Kerala, TN, Karnataka)
- Temperate grasslands/forests are called Sholas in Nilgiris (Western Ghats), Anaimalai and Palani hills

Mangrove Forests

- They are known as Littoral/Swamp forests
- Seen in coastal areas that are highly influenced by tides
- The deltas of Ganga, the Mahanadi, the Krishna, the Godavari and the Kavari are covered by such vegetations
- More in Sundarban deltas → Sundari trees are found here (region: West Bengal)
- The trees are viviparous
- They are also called Pneumatophores (living roots)

Biomes/Forests across the World

- **Temperate Evergreen Forests**: Found in mid-latitudinal coastal areas (US, Canada, Europe, Asia)
- **Temperate Deciduous Forests**: Eastern margins of mid-latitudinal areas; Pheasants and Monals are found here (35°-50°)
- **Tiaga/Boreal Biome** (untouched): 50°-70° N/S
- **Tundra**: Beyond 70° N/S

Indian State of Forest Reports

- 1st published in: 1987
- **17th**: 2021
- It is a Binneal report
- **Forest cover**: 21.7%
- **Tree cover** 2.9%
- **Forest + Trees**: 24.6%

} 2021 Report

- **Forest cover (area-wise)**: Madhya Pradesh > Arunachal Pradesh > Chhattisgarh
- **Forest cover (% wise)**: Mizoram > Arunachal Pradesh > Meghalaya
- **Highest increase**: Andhra > Telangana
- **Highest decrease**: Arunachal > Manipur
- Haryana: Least forest cover
- **Indian Forest Policy (NFP) 1952**: States that 33% geographical area should be under forest or tree cover

↓

Later revised in the year 1988 → It aimed at maintenance of environmental stability through preservation and restoration of ecological balance

Social Forestry

- Social forestry means the management and protection of forest and afforestation on barren lands with the purpose of helping in the environmental, social, and rural development

Chipko Movement

- 1973: Led by Sundarlal Bahugna
- **Forest Day**: 21st March
- Indian Forest Research Institute in Dehradun, Uttarakhand

Grasslands

Types of Grasslands

Tropical Grasslands

- Tall, non-nutritious, elephant grass

Different Names

- Savannah: Africa (Known as Big Game country due to extreme poaching of animals)
- Campos grasslands: Brazil
- Llanos grasslands: Venezuela

Temperate Grasslands

- Shorts and nutritious

Different Names

- Prairies: North America (Known as wheat granaries of the world)
- Steppes: Asia/Europe
- Velds: South Africa
- Downs: Australia
- Pustaz: Hungary
- Canterbury: New Zealand
- Pampas: Argentina (Alpha Alpha grass, a nutrient rich grass is seen here)

Shifting Cultivation

- It is known as Slash and Burn agriculture
- Not good for environment → causes deforestation and soil loses its productivity

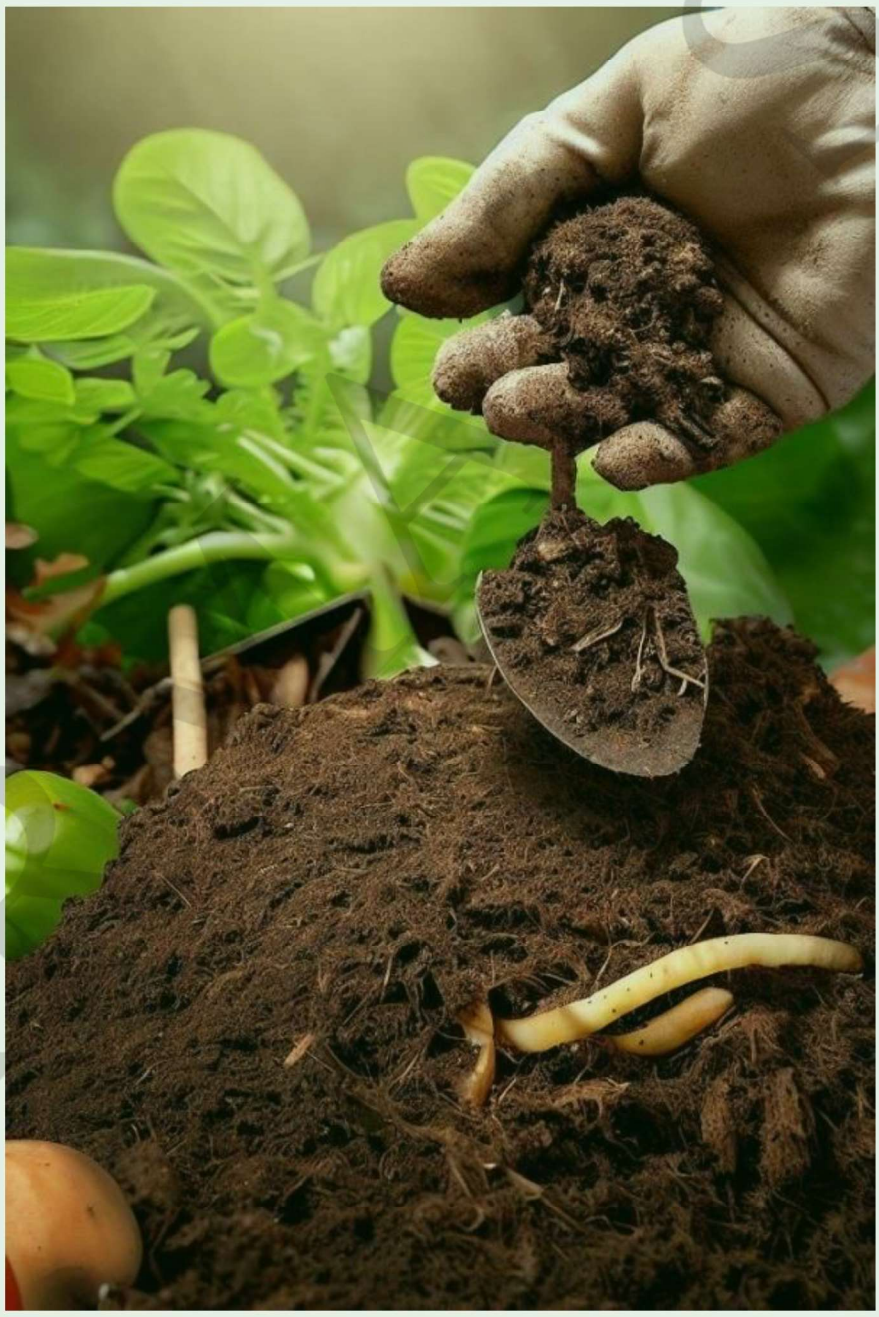
Difference Names across the World

- Indonesia: Ladang
- Mexico: Milpa
- Sri Lanka: Chena
- Vietnam: Ray
- Brazil: Roca
- Venezuela: Konuko

Names across India

- Jhum: North-East
- Kumari: Western Ghats
- Pama Dabi/Bringa: Odisha
- Penda/Podu: Andhra Pradesh
- Dipa: Chattisgarh (Bastar district) and Andaman and Nicobar Islands
- Waltre: Rajasthan
- Kuruwa: Jharkhand
- Bewar/Dahiya: Madhya Pradesh

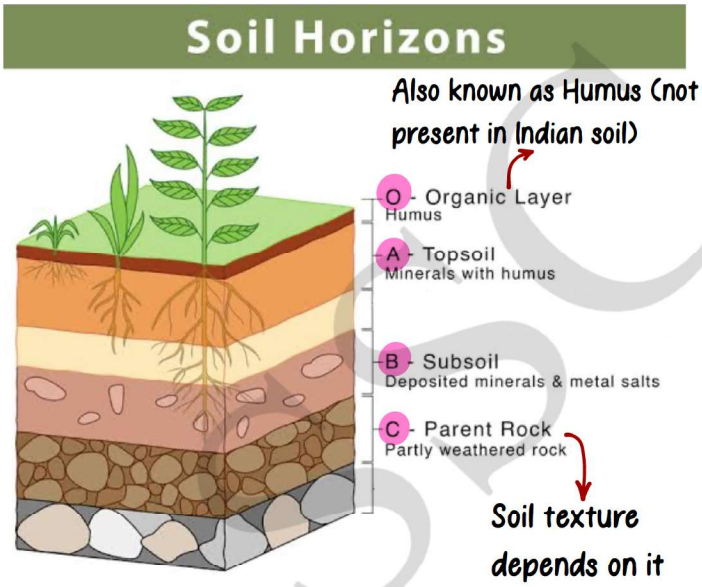
SOIL AND AGRICULTURE



Basic Pointers

- Study of soil: Pedology
- It is renewable natural resource
- It consists of organic (humus) and inorganic materials
- Important factors responsible for formation of soil
  - Relief
  - Parent rock/bed rock
  - Climate
  - Vegetation
  - Other forms of life and time

* Soil can be divided into certain types on the basis of factors responsible for soil formation, colour, thickness, texture, age, chemical, and physical properties



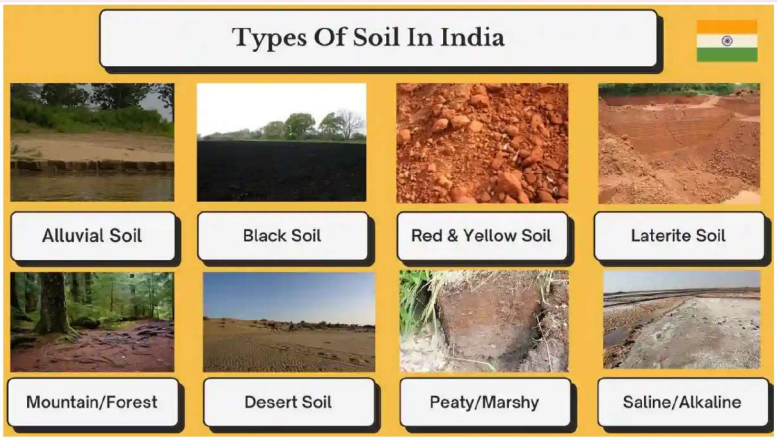
Factors effecting Soil Formation

- Parent material: It determines the soil's → colour, texture, chemical properties, mineral, content, and permeability
- Climate: Temperature and rainfall affect the rate of weathering and humus
  Time: It determines the thickness of soil
- Relief: Accumulation of soil

- ICAR: Indian Council of Agriculture Research
- HQ: New Delhi
- This institute has categorised soil into 8 categories
- Indian soil lacks: N_2, P and Humus (organic matter)

Types of Soil

- Alluvial soil: 40%
- Red soil: 18%
- Black soil: 15%
- Laterite soil: 4.3%
- Arid soil
- Montane soil
- Marshy/Peaty soil
- Saline/Alkaline soil



Alluvial Soil

- Most widely spread (covers 40% area of India → Most fertile type of soil)
- Found in Northern Plains (Uttar Pradesh, Bihar, West Bengal, Assam) + Deltas of Peninsular rivers
- Formed due to deposition of three important Himalaya river system: Indus, Ganga, Brahmaputra
- Found in eastern coastal plains: Delta of Mahanadi, Godavari, Krishna, Kaveri
- Rich in potash and poor in phosphorus
- Types

  Old alluvial: Bhangar → Calcareous concentration; poor in humus and nitrogen (less fertile)

  New alluvial: Khadar → More suitable for agriculture (more fertile)

Black Soil

- Also known as 'Regur'
- Ideal for cotton cultivation (requires 210 frost free days)
- Formed due to eruption of Lava
- Found in Northwestern part of Peninsular Plateau → Maharashtra and Gujarat
- Clayey in nature → Made of extremely fine materials
- Have self-ploughing characteristics → Develops scrap when dry and sticky when moist

  they are rich in iron, calcium carbonate, magnesium, potassium, lime, alumina and poor in humus, nitrogen, phosphate
- Impermeable soil → water does not percolate easily

Red Soil and Yellow Soil

- Formed due to weathering of metamorphic rock
- It is red due to presence of iron oxide
- It develops on crystalline igneous rocks in areas of low rainfall: Tamil Nadu, Karnataka, Maharashtra, Odisha, Chhattisgarh and Piedmont zone of Western Ghats
- Turns yellow when hydrated

→ Leaching: important minerals of soil, either wash away, or they percolate underground

Laterite Soil

- Derived from Latin word 'later' which means brick
- Result of intense leaching process (where important mineral such as silica washes away with the water)
- Found in regions of: High temperature and heavy rainfall → Karnataka, Kerala, Tamil Nadu, Madhya Pradesh, and hilly areas of Odisha and Assam

- Red laterite soil are found in: Tamil Nadu, Andhra Pradesh, Kerala → Region suitable for cashew nut crops
- Favourable for growing tea and coffee (Karnataka)

Arid Soil

- Range from red to brown in colour
- Generally, Sandy in texture and saline in nature (rate of evaporation is greater than the rate of precipitation)
- Found in parts of Rajasthan and Gujarat
- The Kankar layer formation in bottom horizon restrict the infiltration of water

Saline soil —Treatment→ Gypsum
Acidic soil —Treatment→ Lime

Marshy/Peaty Soil

- Seen in coastal areas
- Has organic matter/humus
- Seen in regions of high humidity and high rainfall

Desert Soil

- Seen in extremely low rainfall areas (<50 cm): Western Rajasthan, Gujarat, Haryana

Montane Soil

- High humus is seen

U.S. Taxanomy

Young; Alluvial

- Entisol Inceptisol: Recently formed soils that lack well developed horizons and are commonly found on unconsolidated river and beach sediments of sand
- Vertisol (Black soil): Inverted soils. They are clay rich and tend to swell when wet and shrink upon dying
- Alfisol: Soils with aluminium and iron
- Oxisol: Are heavily weathered and are rich in iron and aluminium
- Gelisols (Permanently frozen): Permafrost soils with permafrost within 2 m of surface or gelic materials
- Histosol: Organic Soil

Micro and Macro Nutrients

Macronutrients

- N: Nitrogen
- P: Phosphorus
- K: Potassium
- Ca: Calcium
- Mg: Magnesium
- S: Sulfur

*Rest other minerals are micronutrients

Soil Erosion and Conservation

- Soil Erosion
- The **denudation of soil cover** and subsequent washing down is described as soil erosion

Soil erosion is also possible due to

→ Water

Sheet Erosion
- When top soil gets washed away due to heavy shower

Gully Erosion
- It is a permanent process when surface water run-off cuts deeply into soil, removing it along drainage lines

→ Gully erosion in **Chambal valley** is referred to as **ravines**

→ Badland topography

Soil Conservation Methods

- **Counter Bunding/Ploughing:** A land management practice for marginal, sloping and hilly land where the soil productivity is very low. It involves placement of the lines of stone along the natural rises of a landscape

- **Mulching**: The process of covering the top soil, with plant material, such as leaves, grass, crop residue, etc.
  → Retains soil moisture

- **Shelter Belts**: Planting rows of trees on one side of an area that prevents the wind from eroding the soil

- **Terrace Farming**: It is the practice of cutting flat areas out of a hilly or mountainous landscape in order to grow crops. Mostly practised in hilly region, such as Himachal Pradesh, Uttarakhand, and certain North-Eastern provinces.

- **Strip Farming:** Type of farming that involves dividing fields into long, narrow strips, and alternating crops in a rotation system

Contour Bunding

Mulching

Shelter belts

Terrace farming

Strip farming

Agriculture

Types of Farming

Primitive Subsistence Farming

- Is practised on small patches of land with the help of primitive tools like hoe, dao, digging sticks, and family/community labour
- This type of farming depends upon: Monsoon, natural fertility of soil and suitability of other environmental conditions
- It is slash and burn agriculture

Intensive Subsistence Farming

- Is practised in areas of high population pressure on land
- It is labour intensive farming → Use of high doses of biochemical inputs and irrigation to obtain higher production
- Through 'Right of Inheritance' → division of land among successive generation has rendered land-holding uneconomical in size

Commercial Farming

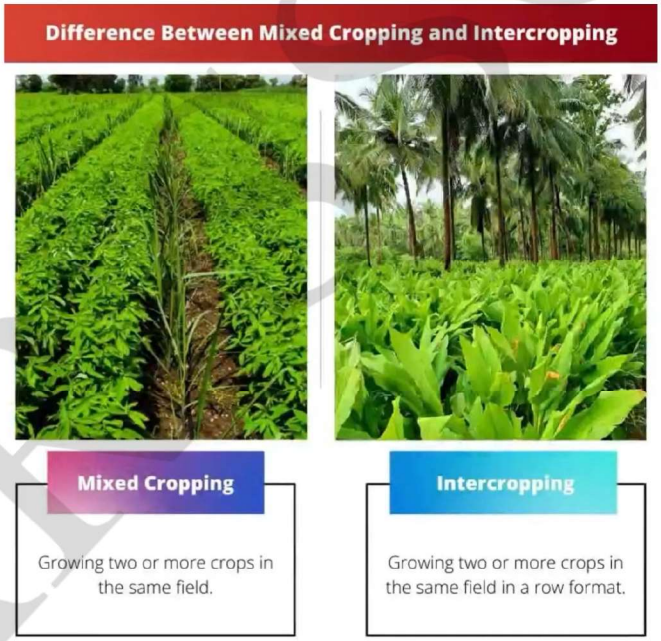
- In this type of farming, single crop is grown on large area
- Use of higher doses of modern inputs → High Yielding Variety (HYV) seeds, chemical fertilisers, insecticides, and pesticides to obtain high productivity
- Plantation is also a type of commercial farming → Important crops: Tea, coffee, rubber, sugar cane, banana, etc.
- All produced used as raw materials

Mixed and Intercropping

- **Mixed Farming**: Type of farming, which involves growing of crops and raising of livestocks (Agriculture + Livestock)

- **Intercropping**: Practice of growing two or more crops in close proximity to each other on the same piece of land

- **Similarities between Mixed and Intercropping**
  Growing two or more crops in a same piece of land



Differences

Mixed Cropping	Intercropping
• Seeds of two different crops are mixed before sowing	• Seeds are not mixed and grown in a row format

Different Cropping Patterns

Kharif
- Sowing: July
- Harvesting: Sept–Oct
- Also known as Monsoon crops
- Rice, sugarcane, jute, cotton, tobacco, maize, soyabean, groundnut

Rabi
- Sowing: Oct
- Harvesting: April
- Wheat, barley, gram, Mustard, linseed, pea, rapeseed, castor
  Winter rainfall is beneficial

Zaid
- Short cropping season
- May–June
- Watermelon, muskmelon, cucumber, fodder crops

Some Major Crops

Rice
- Also known as paddy before processing
- India is 2nd largest producer after China
- Sowed in swampy areas → Methane and gases produced
- Requires: High-temperature (>25°C) and high rainfall (>100 cm)
- In Eastern India (WB): 3 seasons

→ India's most consumed staple crops: Rice and Wheat

Aus
- Harvesting: August
- Sowing: June

Aman
- Harvesting: Nov–Dec
- Sowing: August

Boro
- Harvesting: April
- Sowing: Dec–Jan

Wheat
- Rain required: 50–70 cm

Sugarcane
- Temperature required: 21–27°C
- Rain required: 75–100 cm

Tea
- Grown in acidic soil → Requires well-drained soil
- Rich in humus and organic content
- Requires shadow
- Topmost producer: China > India > Kenya
- India (topmost producer): Assam

Leguminous Crops
- India is largest consumer/producer
- Nitrogen fixing bacteria (Rhizobium) reside in the roots of these plant
- Eg: Pulses, rajma, soyabeans (Top producer: Madhya Pradesh)
  - rajma → No Rhizobium bacteria inside their roots

Millets
- Also known as Superfoods/Sri Anna
- Eg: Bajra, ragi (finger millets), jowar (Sorghum)
- Topmost producer: Rajasthan

Oil Seeds
- India is 2nd largest producer after China
- Eg: Groundnut, coconut, mustard, sesame, cotton seed, soyabean
  - Groundnut → Topmost producer: Gujarat

Horticulture Crops
- Fruits and vegetables
- India produces 13% of world's vegetables

Coffee
- Coffee bowl of the world: Brazil (topmost producer)
- India (topmost producer): Karnataka
- Soil required: Laterite
- Blossom showers helps in growth of coffee
- According to 2008 data: India produces 3.2% of the world

→ Brazil: Coffee bowl of the world

- Arabica
- Liberica
- Robusta

} 3 varieties found

Fibre Crops

Cotton
- It requires black soil
- Fibre crop and also known as silver fibre
- Requires: 210 frost free days
- Requires 6 to 8 months to mature

Jute
- Golden fibre
- Topmost producer: India (West Bengal)
- Topmost exporter: Bangladesh
- Nor-westers good for growth of jute

Hemp

Silk
- Rearing of silk is called: Sericulture

Different Types of Revolution

Green Revolution

- 1st in: Mexico + Latin America (1940s–60s)
- Term by: William Gaud
- Father (world): Norman Borlaug (USA; 1970: Nobel Peace Prize)
- Father (India): M S Swaminathan
  - PL-480 High Yielding Variety (HYV) of wheat was imported from Mexico, USA
  - Rice: IR8 variety (Miracle) from Philippines

Agriculture Revolution in India			
●	Black Revolution		Petroleum
●	Blue Revolution		Fish
●	Brown Revolution		Leather
●	Golden Revolution		Fruit / Honey
●	Green Revolution		Food Grains
●	Grey Revolution		Fertilizer
●	Pink Revolution		Onion
●	Red Revolution		Meat / Tomato
●	Silver Revolution		Egg / Poultry
●	White Revolution		Milk / Dairy
●	Yellow Revolution		Oil Seeds
●	Evergreen Revolution		Overall Development

In India

- It was introduced in two phases
- 1st phase: 1960s–70s → Affluent states of Punjab, Haryana, Andhra Pradesh (Wheat and Rice)

July 1968: Special stamps by Indira Gandhi

3rd FYI

- Estd: FCI, CACP in 1965 → To announce MSP
- 1965 production of cereals: 72.4 M tone
- 1978 production: 131 M tone

→ 2nd phase: 1970s–80s → Sustainable farming

- HQ of Second Green Revolution (SGr) cell: ICAR, Patna

Blue Revolution

- Father: Harilal Chaudhuri and Arun Krishnan

White Revolution

- Also known as "Operation Flood"
- Launched in: 1970
- Father: Verghese Kurien
- Reduce scarcity of milk production in India

Yellow Revolution

- Father: Sam Pitroda

Drawbacks of Green Revolution

- Groundwater levels low ↓
- Soil alkalinity high ↑
- Disparity between farmers increased
- Commercial farmers benefited more

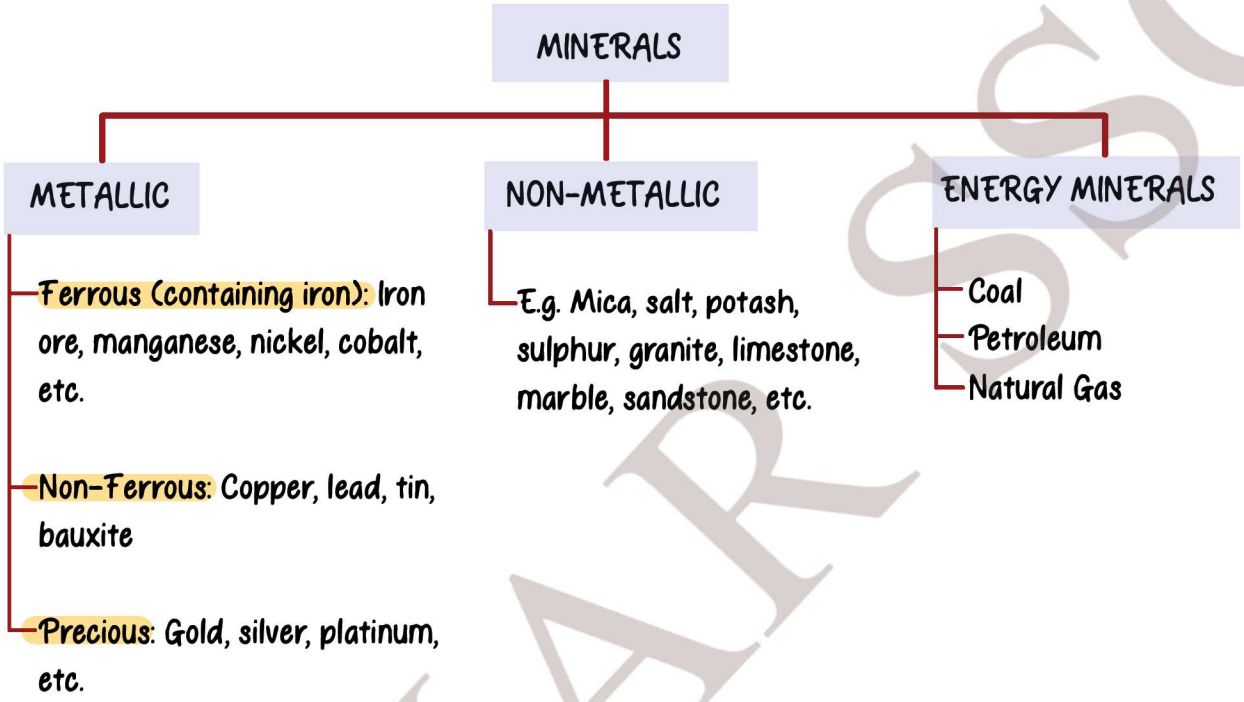
GM Crops (Genetically Modified Crops)

- These are crops/plants that have had their DNA modified using genetic engineering techniques
- Eg: Bt brinjal, Bt cotton

MINERALS

Minerals

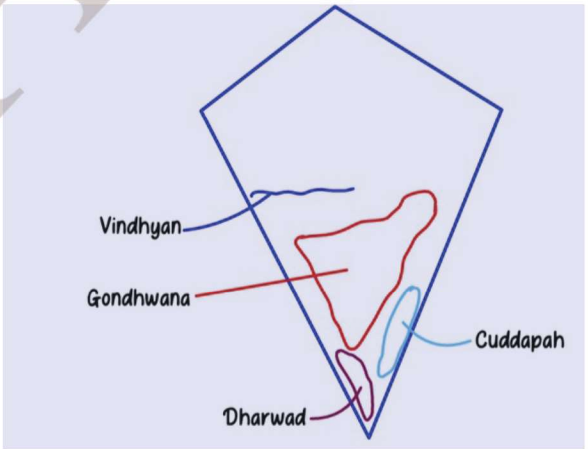
- Mineral is a natural substance of organic or inorganic origin with definite chemical and physical properties
- Homogenous, naturally occurring substance with a definable internal structure



Distribution of Minerals in India

- Most of the metallic minerals in India occur in the peninsular plateau → Rurh plateau → Chota Nagpur plateau
- Over 97% of coal reserves occur in the valleys of Damodar, Son, Mahanadi and Godavari
- Petroleum reserves are located in the sedimentary basins of Assam, Gujarat and Mumbai High i.e. off-shore region in the Arabian Sea
- Most of the major mineral resources occur to the east of a line linking Mangaluru and Kanpur

Minerals are generally concentrated in three broad belts in India

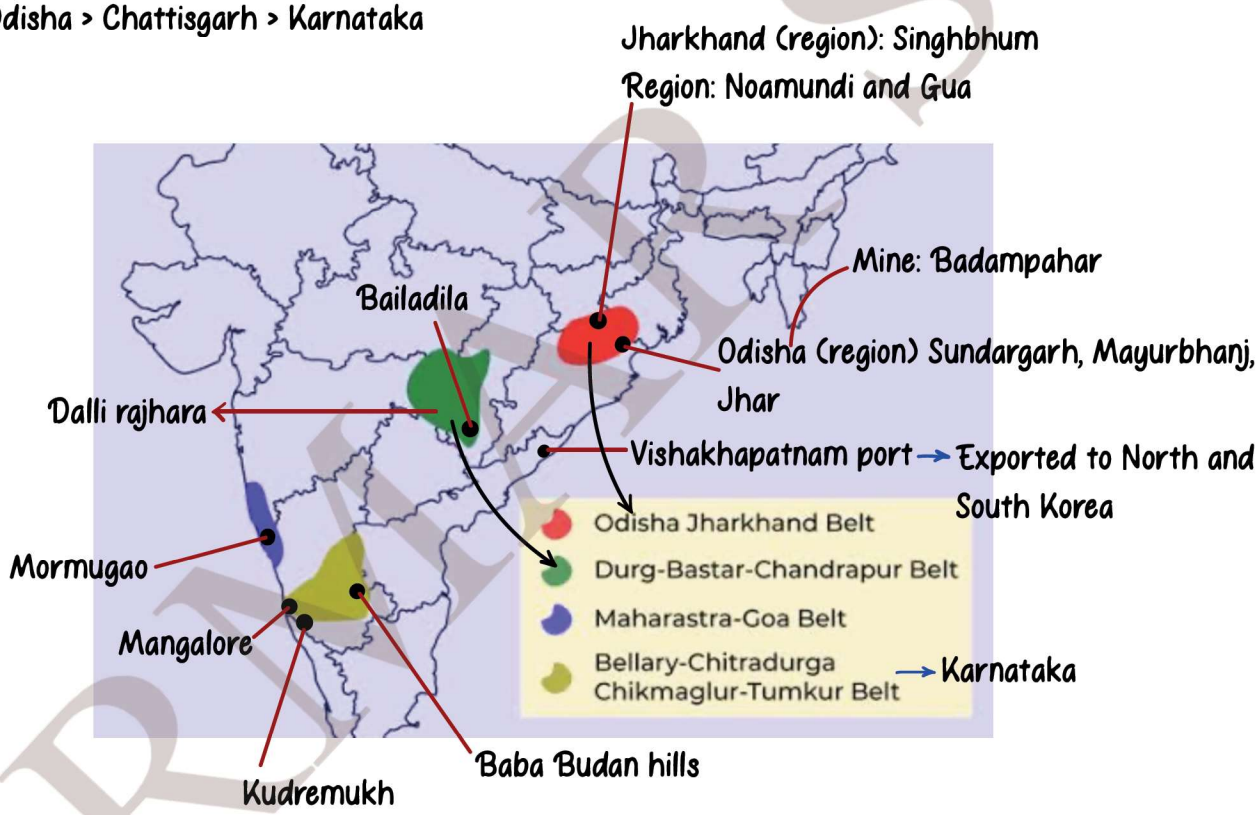


- Gondhwana: Gold
- Dharwad/Cuddapah: Gold, Iron
- Vindhyan: Non-metallic minerals

Ferrous Minerals

Iron Ore

- Magnetite is the finest iron ore with a very high content of iron up to 70%
- Hematite ore is the most important industrial iron ore in terms of the quantity used, but has a slightly lower iron content than magnetite (50–60 %)
- In 2018–19, almost entire production of iron ore (97%) accrued from Odisha, Chhattisgarh, Karnataka and Jharkhand
- Reserve (topmost): Odisha
- Production: Odisha > Chattisgarh > Karnataka



Manganese

- Manganese is mainly used in the manufacturing of steel and ferro-manganese alloy
- It is also used in manufacturing bleaching powder, insecticides and paints

- Topmost producer: Madhya Pradesh

Non-Ferrous Minerals

Copper

- 1st metal to be discovered by humans
- The Balaghat mines in Madhya Pradesh, Khetri mines, Jhunjhunu and Alwar (region) in Rajasthan and Singhbhum district of Jharkhand are leading producers of copper

Aluminium

- Primary ore: Bauxite
- It is used in aircraft because of its lightweight
- India's bauxite deposits are mainly found in the Amarkantak plateau, Maikal hills and the plateau region of Bilaspur-Katni
- Odisha is the largest Bauxite producer
- Panchpatmali deposits in Koraput district are the most important bauxite deposits in Odisha
- Largest producer of bauxite: Australia

Precious Metals

Gold

- Topmost (World): China > Australia
- Topmost producer (India): Karnataka → Kolar Gold Field, Hutti Gold Field
- Andhra Pradesh: Ramagiri

Non-Metallic Minerals

Mica

- Due to its excellent di-electric strength, low power loss factor, insulating properties and resistance to high voltage, it is used in electric and electronic industries
- Mica deposits are found in northern edge of the Chota Nagpur plateau. Koderma Gaya-Hazaribagh belt of Jharkhand is the leading producer
- In Rajasthan, the major Mica producing area is around Ajmer
- Nellore mica belt of Andhra Pradesh is also an important producer in the country

Limestone

- It is a sedimentary rock
- It is found in association with rocks, composed of calcium carbonates, or calcium and magnesium carbonates
- It is basic raw material for the cement industry and essential for melting iron ore in blast furnace

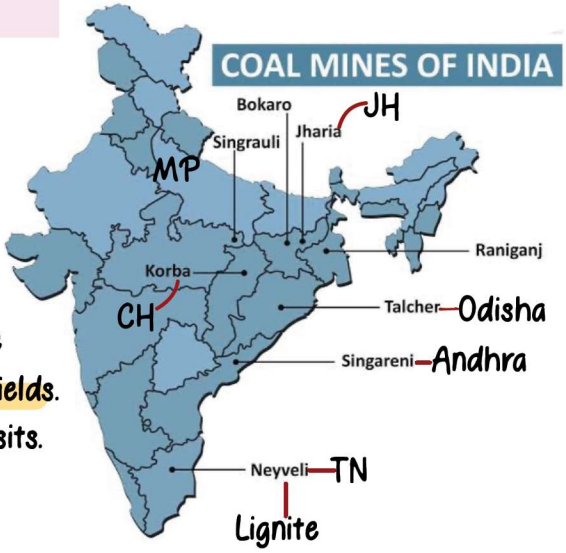
Diamond

- Madhya Pradesh (Panna), is the only state that produces diamond

Energy Resources

- Sources of Energy
  - Conventional sources
    - Commercial
      - Coal
      - Petroleum
      - Electricity
    - Non-commercial
      - Fire wood
      - Straw
      - Dried dung
  - Non-conventional sources
    - Bio energy
    - Solar energy
    - Wind energy
    - Tidal energy
    - Energy from urban waste

Coal



- Also known as buried sunshine/black diamond/black gold
- In India, coal is the most abundantly available fossil fuel
- In India coal occurs in rock series of two main geological ages, namely Gondwana, a little over 200 million years in age and in tertiary deposits which are only about 55 million years old.
- The major resources of Gondwana coal, which are metallurgical coal, are located in Damodar valley. Jharia, Raniganj, Bokaro are important coalfields.
- The Godavari, Mahanadi, Son and Wardha valleys also contain coal deposits. Tertiary coals occur in the north eastern states of Meghalaya, Assam, Arunachal Pradesh and Nagaland
- Reserve: Odisha > Jharkhand > Chattisgarh
- Production: Chattisgarh > Odisha

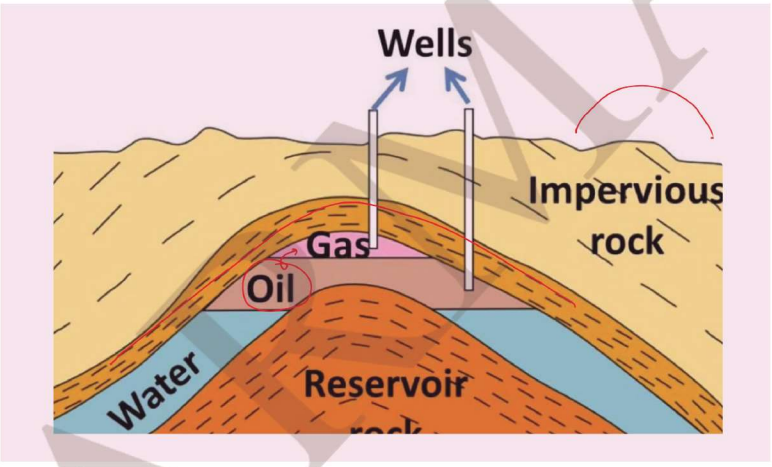
Types of Coal

*A good coal has: Calorific value ↑, moisture content ↓, carbon content ↑

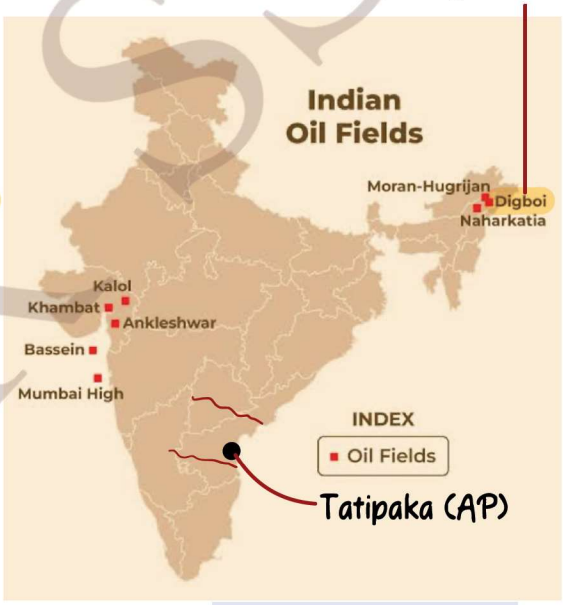
- Anthracite: 80–90%; highest quality, hard coal
- Bituminous: 70–80%; coal that has been deep and subjected to increase temperatures
- Lignite: 50–70%; a great brown coal, which is soft with high moisture content
- Peat: Less than 50%; decaying plants in swamps produce peat, has a low carbon and high moisture content and low heating capacity

Petroleum

- Most of the petroleum occurrences in India are associated with anticlines and fault traps in the rock formations of the tertiary age
- Petroleum is also found in fault traps between porous and non-porous rocks. Gas, being lighter usually occurs above the oil
- Mumbai High, Gujarat and Assam are major petroleum production areas in India
- Ankleshwar is the most important field of Gujarat. Assam is the oldest oil producing state of India. Digboi, Naharkatiya and Moran-Hugrijan are the important oil fields in the state



- Commissioned on: 1901
- 1st oil refinery of India



*Off-shore: Seabed
*On shore: Earth

Natural Gas

- Methane (CH_4) is a primary component of natural gas (70–90%)
- Natural Gas is found with petroleum deposits and is released when crude oil is brought to the surface
- It is used as fuel in power sector to generate electricity

- India's major gas reserves are found in the Mumbai High and allied fields along the west coast which are supplemented by finds in the Cambay basin. Along the East Coast, new reserves of natural gas have been discovered in the Krishna-Godavari basin
- The first 1,700 km long Hazira-Vijaipur-Jagdishpur (HVJ) cross country gas pipeline, constructed by GAIL (India), linked Mumbai High and Bassein gas fields with various fertilizer, power and industrial complexes in western and northen India

Gujarat → MP → UP → Pipeline: 1986

Electricity

- Hydroenergy/Hydroelectricity: It is the process of generating electricity from kinetic energy of moving water
- Thermal: Use of Coal, Petroleum and Natural Gas to generate electricity

Non-Conventional Sources of Energy

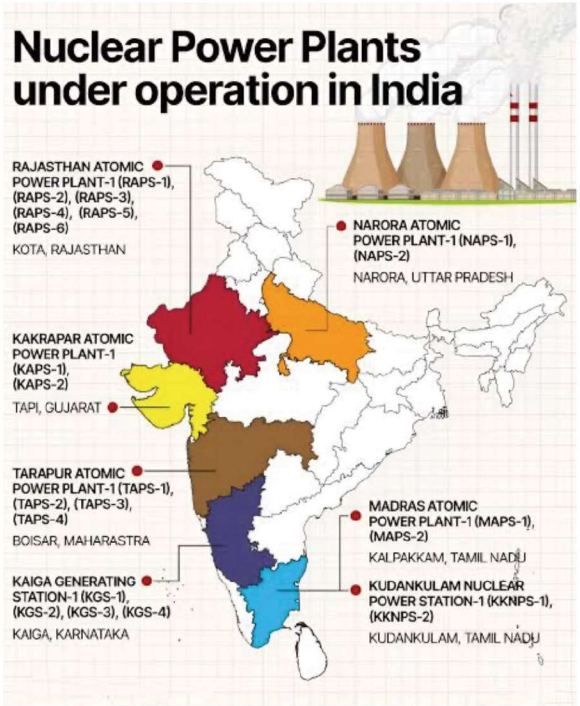
Nuclear/Atomic Energy

- It is obtained by altering the structure of atoms → Nuclear fission
- When such an alteration is made, much energy is released in the form of heat and this is used to generate electric power
- Uranium and Thorium, which are available in Jharkhand and the Aravalli ranges of Rajasthan → Jaduguda mines (Jharkhand)
- Monazite sands of Kerala is also rich in Thorium

- Apsara: 1st nuclear reactor
- Father of nuclear programme: H. J. Bhabha

Nuclear Power Plants of India

- Tarapur: Maharashtra
- Kudankulam and Kalpakkam: Tamil Nadu
- Kaiga: Karnataka → Fast breeder reactor
- Narora: Uttar Pradesh
- Rawatbhata: Rajasthan
- Kakrapar: Gujarat



Solar Energy

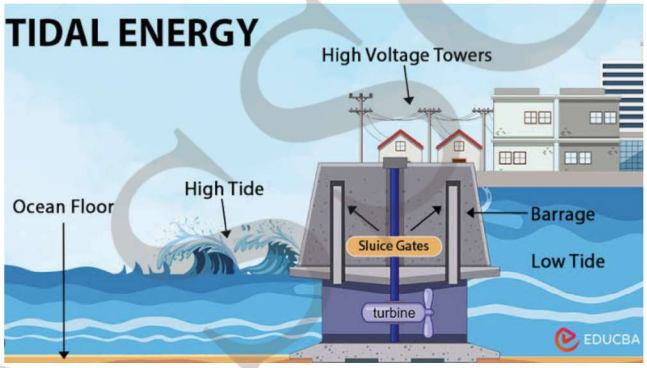
- It is a renewable source of energy
- The radiant heat and light from the sun that can be harness to generate electricity, heat, and other forms of energy
- Photovoltaic technology convert sunlight directly into electricity
- International Solar Alliance: HQ → Gurugram

Wind Energy

- It is a renewable source of energy
- India has a great potential of wind power. The largest wind farm cluster is located in Tamil Nadu from Nagarcoil to Madurai

Tidal Energy

- Ocean tides can be used to generate electricity
- In India, the Gulf of Khambhat, the Gulf of Kutch in Gujarat on the western coast and Gangetic delta in Sunderban regions of West Bengal provide ideal conditions for utilising tidal energy



Geothermal Energy

- Geothermal energy refers to the heat and electricity produced by using the heat from the interior of the Earth
- Two experimental projects have been set up in India to harness geothermal energy. One is located in the Parvati valley near Manikarn in Himachal Pradesh and the other is located in the Puga Valley, Ladakh

Biomass

CO_2 : 30–45%

CH_4 : 55–70%

- Shrubs, farm waste, animal and human waste are used to produce biogas for domestic consumption in rural areas
  - Generated through anaerobic digestion
- Decomposition of organic matter yields gas, which has higher thermal efficiency in comparison to kerosene, dung cake and charcoal
- The plants using cattle dung are known as 'Gobar gas plants' in rural India

* Anaerobic digestion: Microorganism breaks down, biodegradable material in absence of oxygen

WORLD MAP

Continents

Area wise	Population wise
Asia	Asia
Africa	Africa → Known as "continent of continents"
North America	Europe
South America	North America
Antarctica	South America
Europe	Australia/Oceania
Australia/Oceania	Antarctica → Known as White continent

Continents
- Top (Area + Population wise): Asia
- 2nd (Area + Population wise): Africa

ASIA

- **Strait:** a narrow water body that separates two landmasses/joins two water bodies

Strait of Malacca
- Separates Malaysia and Indonesia
- Joins Java Sea and Andaman Sea

Sunda Strait
- Separates Sumatra and Java
- Joins Java Sea and Indian Ocean

- Indonesia
- Malaysia
- East Timor
- Thailand
- Cambodia
- Laos
- Vietnam
- Myanmar
- Philippines

CAMBODIA
- Capital: Phnom Penh

VIETNAM
- Capital: Hanoi

LAOS
- Capital: Vientiane
- Landlocked country

INDONESIA
- Country with most no. of Muslim population
- Sumatra (Largest island), Kalimantan, Sulawesi, Java, Papua (5 main islands of Indonesia)
- Capital: Jakarta (at present) → Will change to Nusantra
  - Due to Global Warming
- Most of the islands in Indonesia are volcanic islands

MALAYSIA
- Capital: Kuala Lumpur

EAST TIMOR
- Capital: Dili

THAILAND
- Capital: Bangkok

MYANMAR
- Earlier known as "Burma"
- Capital: Nay Pyi Taw

PHILIPPINES
- Capital: Manila

Gobi Desert (Cold desert)

Islands disputed between Japan and Russia

Located between mainland China and Korean Peninsula

A country that is only surrounded by land and no ocean/ coastline

Honshu: largest island of Japan

- South Korea
- North Korea
- Yellow Sea
- Japan
- Kuril Islands
- Taiwan

LAOS
- Landlocked country

SOUTH KOREA
- Capital: Seoul
- Shares border with North Korea

Separated by 38th parallel

NORTH KOREA
- Capital: Pyongyang
- Shares borders with China and Russia

*Lake Baikal: World's deepest lake in Russia

SOUTHWEST ASIA

JAPAN
- Largest island: Honshu
- Capital: Tokyo

TAIWAN
- Earlier known as Formosa
- Capital: Taipei

*Kuril islands is under territorial dispute between Japan and Russia

TURKMENISTAN
- Capital: Ashgabat

UZBEKISTAN
- Capital: Tashkent

KAZAKHSTAN
- Capital: Astana

TAJIKISTAN
- Capital: Dushanbe

KYRGYZSTAN
- Capital: Bishkek

Caspian Sea (it is a lake), a landlocked water body of Europe and Asia

All landlocked

*Liechtenstein and Uzbekistan are the only doubly landlocked countries

Country that is surrounded by landlocked countries

*CASPIAN SEA → Surrounding 5 countries

- Rivers Volga, Ural, and Terek discharge into the Caspian Sea
- Old name: Persia

IRAN
- Capital: Tehran

AZERBAIJAN
- Capital: Baku

T: Turkmenistan
A: Azerbaijan
R: Russia
I: Iran
K: Kazakhstan

*BLACK SEA → Bordered by

- Rivers Danube, Dnieper, Dniester discharges in the Black Sea

The: Turkiye
Bu: Bulgaria
R: Russia
G: Georgia
U: Ukraine
R: Romania

KERCH STRAIT
- It connects Black Sea and the Sea of Azov
- Separates Kerch (Ukraine) and Russia

BOSPORUS STRAIT
- It connects the Black Sea to the Sea of Marmara

TÜRKIYE
- Capital: Ankara
- Spreads across two continents: Europe and Asia
- Currency: Lira

UKRAINE
- Capital: Kyiv

RUSSIA
- Capital: Moscow

IRAQ
- Old name: Mesopotamia
- Capital: Baghdad

Trans-Siberian Rail link (world's longest rail link) → 9288 km in length

- Connects Vladivostok to Siberia

Strait of Hormuz

- Connects the Persian Gulf (west) to the Gulf of Oman and the Arabian Sea (southeast)

- JORDAN
  Capital: Amman
- LEBANON
  Capital: Beirut

Referred as "the land between two rivers"
— Tigris and Euphrates rivers

SUEZ CANAL

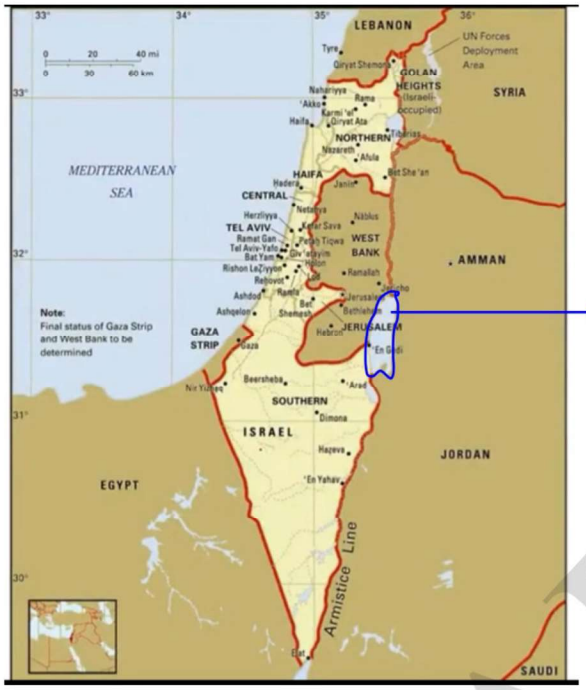
- Connects the Mediterranean Sea to Red Sea

Mediterranean Sea

Red Sea

Bab-al-Mandab Strait (Gateway of Grief or the Gate of Tears)

- Connects the Red Sea to the Gulf of Aden



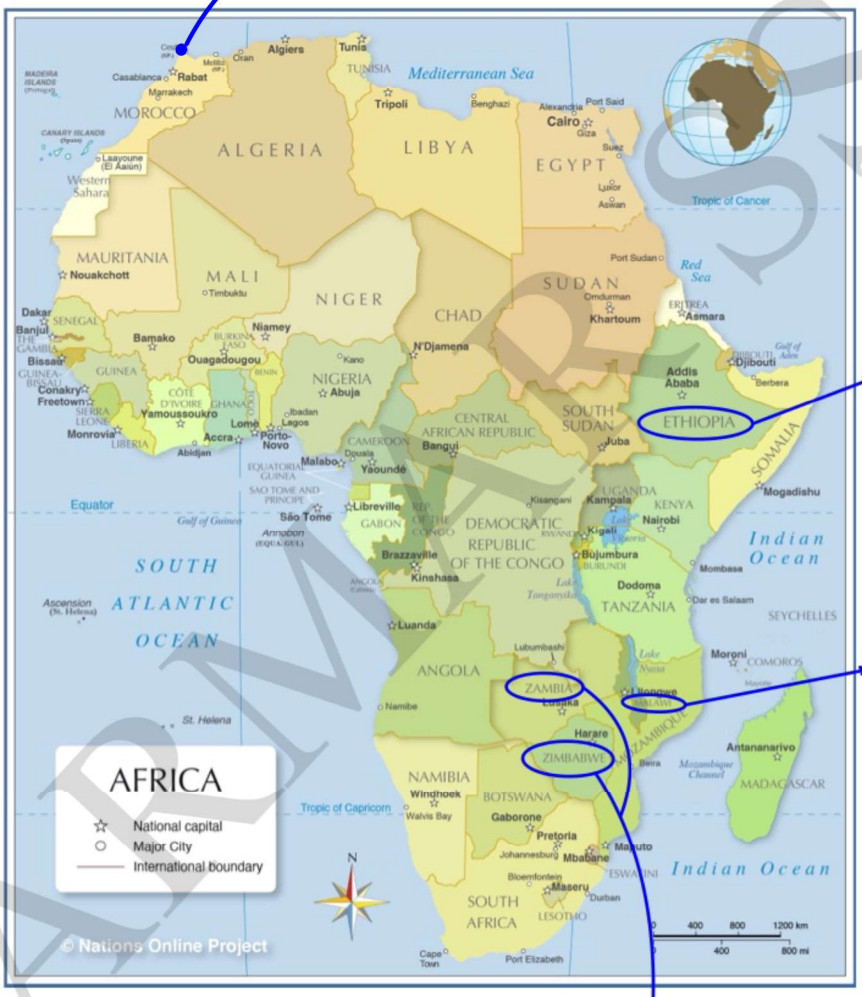
- RED SEA → Bordering countries
  - D: Djibouti
  - E: Eritrea
  - S: Saudi Arabia
  - S: Sudan
  - E: Egypt
  - Y: Yemen

→ Dead Sea: high salinity (Alkalinity: 34.2%)

*Palk Strait: Between India and Sri Lanka

AFRICA

- **Strait of Gibraltar:** Between Africa and Europe
- **Connects:** Atlantic Ocean to Mediterranean Sea



- **Old name:** Abyssinia
- **Old name:** Nyasaland
- Zimbabwe + Zambia (previously known as) → Rhodesia

AFRICA

- Known as "Continent of Continents"
- Known as **Dark Continent** and **Black Continent**

- Longest river of the world: Nile (formed from Blue Nile + White Nile)
  - Empties in: Mediterranean Sea
  - Origin: Lake Victoria of Tanzania
  - Empties at: Mediterranean Sea
- Highest peak of Africa: Mt. Kilimanjaro

NORTH AMERICA

Earlier was part of Russia

Largest Island

Arctic Ocean

Bering Strait

- Connects Arctic Ocean and Pacific Ocean
- Separates: Asia and North America

49th Parallel Line

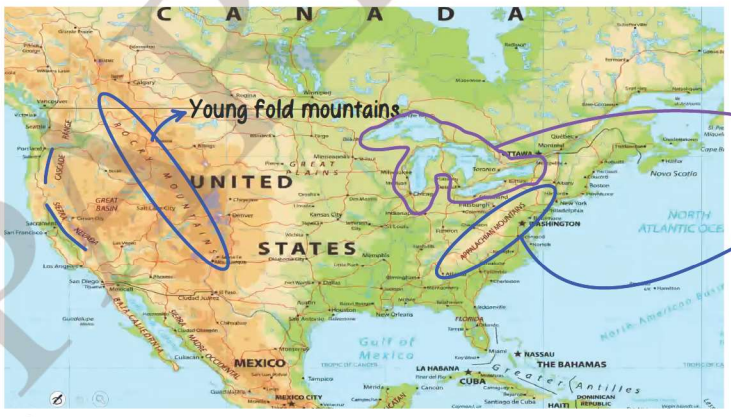
- Boundary between USA and Canada

- **Congo river**: Cuts the Equator twice
- **Limpopo**: Cuts the Tropic of Capricorn twice
- Africa is the only continent from where **all three important latitudes pass** (Equator; Tropic of Cancer; Tropic of Capricorn)

Panama Canal

- Separates the Atlantic Ocean with Pacific Ocean
- Links North America and South America

NORTH AMERICA



CANADA

- **Capital**: Ottawa

Great Lakes: Near Canada-USA border

Old fold mountains

Great Lakes consists of

- **H**: Huron
- **O**: Ontario
- **M**: Michigan
- **E**: Erie
- **S**: Superior

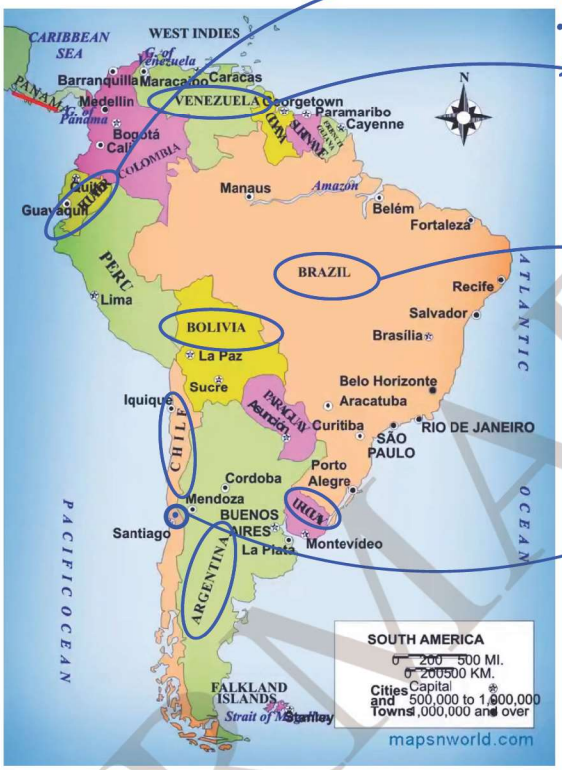
Desert

- Mojave Desert
- Sonoran Desert

- **Lake Superior:** largest freshwater lake in the world

- **Highest peak of North America:** Mt. McKinley (also called Denali)

SOUTH AMERICA



ECUADOR
- **Capital:** Quito
- First country from which equator passes
- Mountain in Equador: Mt. Cotopaxi (active stratovolcano)

VENEZUELA
- Capital: Caracas

BRAZIL
- **Capital:** Brasilia
- **Currency:** Brazilian Real

- **Ojas del Salado:** Highest mountain in Chile
- It is a dormant complex volcano in the Andes on Argentina-Chile border

CHILE
- **Capital:** Santiago

PARAGUAY
- **Capital:** Asuncion

ARGENTINA
- **Capital:** Buenos Aires

BOLIVIA
- **Capital:** La Paz

URUGUAY
- Capital: Montevideo

Amazon forest

ANDES MOUNTAIN RANGE (World's longest chain of mountains)

- Young fold mountains
- Highest peak: Mt. Aconcagua (Argentina) → 6959 m
- Driest desert: Atacama Desert

EUROPE

Arati Saha was 1st Indian women swimmer to cross the English Channel

Separates Europe and Asia

Ural Mountain Ranges (Old Fold mountains)

Highest peak: Mt. El'brus (5642 m)

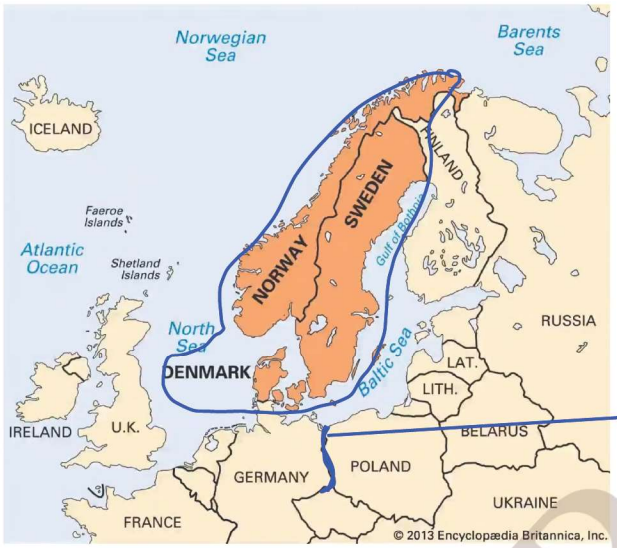
English Channel

Germany: Black forest (mountain range)

Alps Mountain Ranges (Young fold mountains)

CYPRUS

- Underwater canyon: Eratosthenes

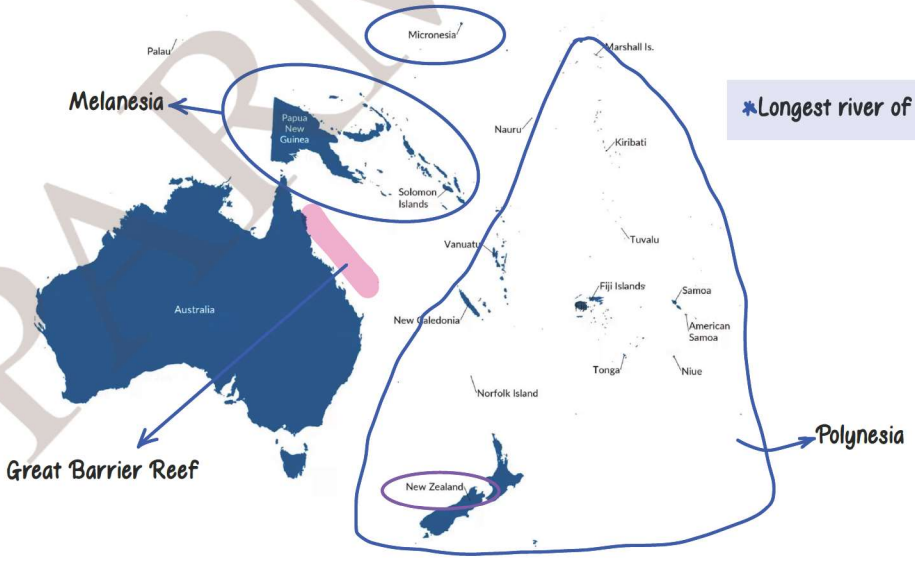


Hindenburg Line between Germany and Poland (German defensive line in French territory during World War I)

- Scandinavian countries: Norway + Sweden + Denmark
- Nordic countries: Denmark + Finland + Sweden + Norway + Iceland

- Block mountain in Germany: Rhine Valley
- Vosges mountain in France

OCEANIA



*Longest river of Australia: Murray

Bass Strait

Great Australian Desert (Gibson Desert)

ARCTIC

- India's first research centre: HIMADRI
  - Estd: 2008

ANTARCTICA

- Highest peak: Mt. Vinson
- Indian Research Centre in Antarctica: Bharati, Dakshin Gangotri, Maitri
  - Estd: 1984

NATIONAL PARKS AND BIOSPHERE RESERVES

Conservation Sites

- Areas that are legally protected to preserve their natural or cultural significance

Different conservation sites are

In-Situ

Conserving the wildlife in the natural habitat

Example

- National Parks
- Wildlife Sanctuary
- Biosphere Reserves

Ex-Situ

Conserving the wildlife outside their natural habitat

Example

- Zoo/Zoological gardens
- Aquarium
- Botanical gardens

Differences

NATIONAL PARKS

- Areas reserved for wildlife where they can freely use the habitat and natural resources

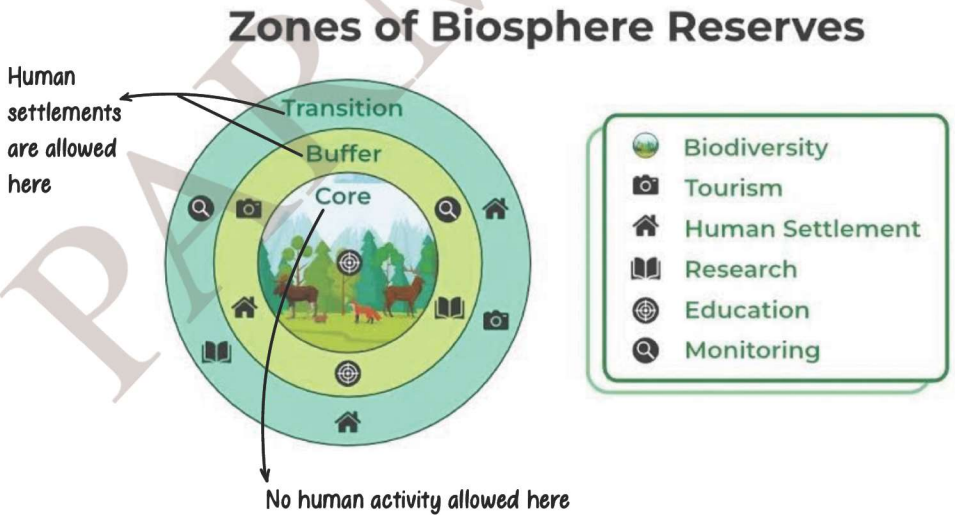
WILDLIFE SANCTUARY

- Areas where animals (fauna) are protected from any disturbance to them and their habitat

BIOSPHERE RESERVES

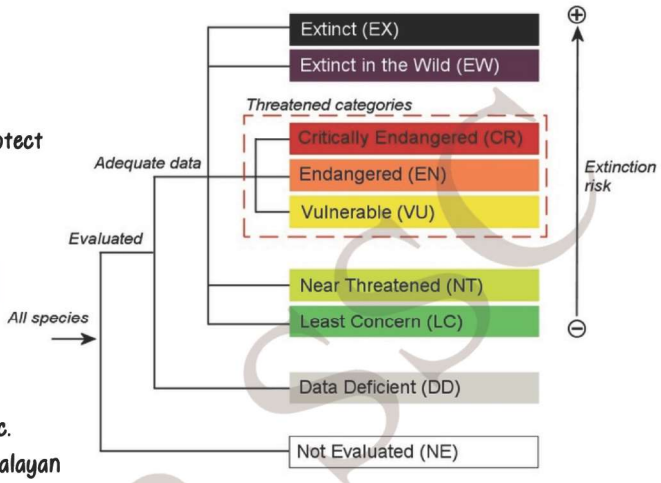
- Large areas of protected land for conservation of wildlife, plant (flora), and animal resources, and traditional life of the tribals living in the area

Zones of Biosphere Reserves



IUCN: International Union for Conservation of Nature

- HQ: Gland, Switzerland
- Established in: 1948
- IUCN maintains a Red Data Book (it records, endangered species to raise awareness and protect by diversity)



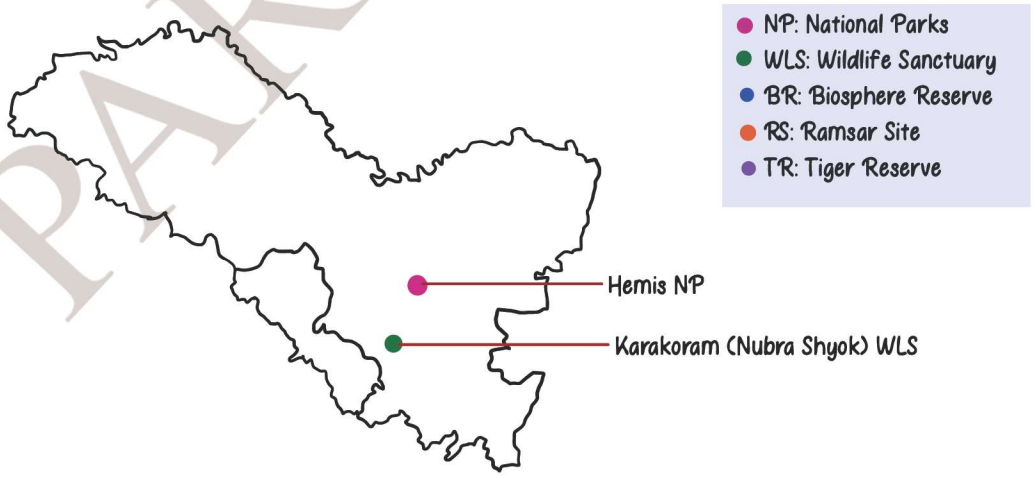
WILDLIFE PROTECTION ACT 1972

Total: 5 schedules

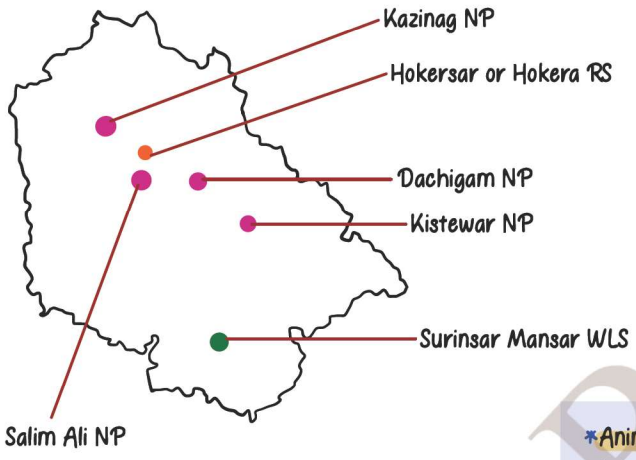
- Schedule I: Endangered species
  Black buck, snow, leopard, Asiatic, cheetah, etc.
- Schedule II: Indian cobra, Assam Macaque, Himalayan black bear, etc.
- Schedule III & IV: Not endangered
  Schedule III: Sambhar, chital, etc.
  Schedule IV: Crabs, Flamingo, etc.
- Schedule V: Fruit bat, rats, common crow
  → Vermin (disease carrying animals)
- Schedule VI: Specified plants

National Parks

Ladakh



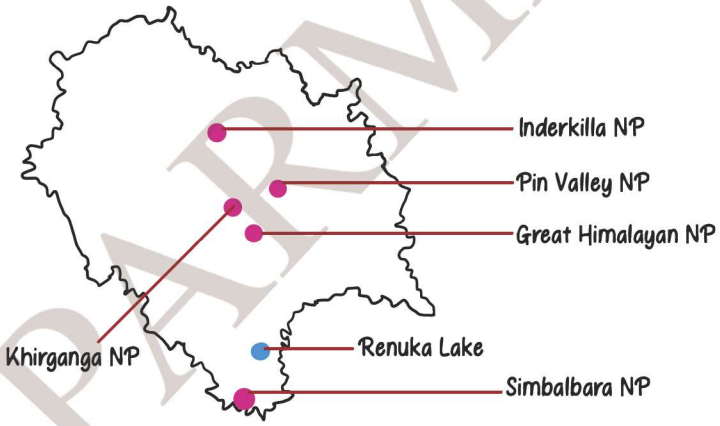
Jammu and Kashmir



TRICK
- Salim: Salim Ali NP
- Ne
- Do Gram: Dachigam NP
- Kish: Kistewar NP
- Di
- Kazi: Kazinag NP
- Ko

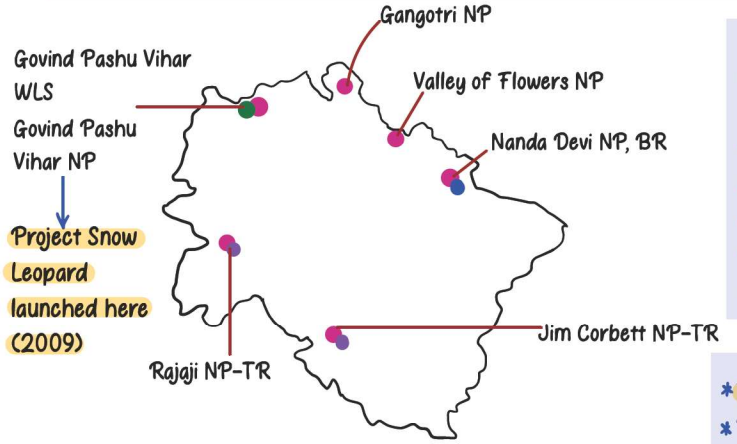
*Animals found: Kashmir Hangul Stag, Snow Leopard

Himachal Pradesh



TRICK
- Inder: Inderkilla NP
- Him: Great Himalayan NP
- Pe
- Khir: Khirganga NP
- Kha raha tha aur
- Pin: Pin Valley NP
- Se
- Sim: Simbalbara
- Nikal raha tha

Uttarakhand

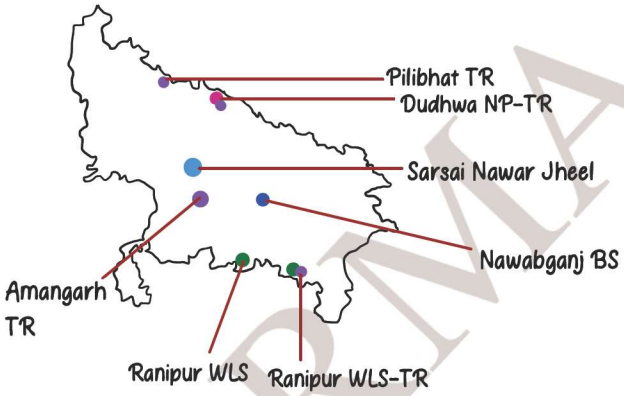


TRICK

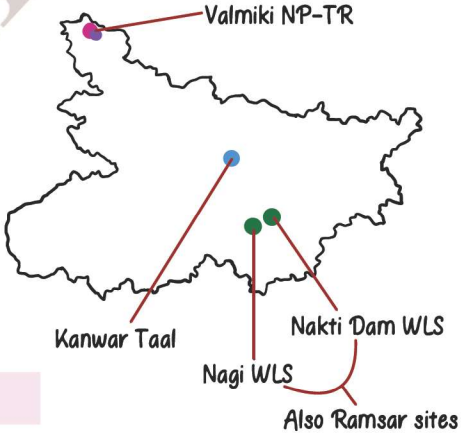
- Rajaji: Rajaji NP
- Flowers: Valley of Flowers NP
- Leke
- Jimmy: Jim Corbett NP
- Devi: Nanda Devi NP
- Se milne pahonche
- Pashu Vihar me: Govind Pashu Vihar NP

* 1st NP of India: Jim Corbett NP (1936)
* Project Tiger launched from Jim Corbett in 1973
* Project Tiger Act passed in 1992

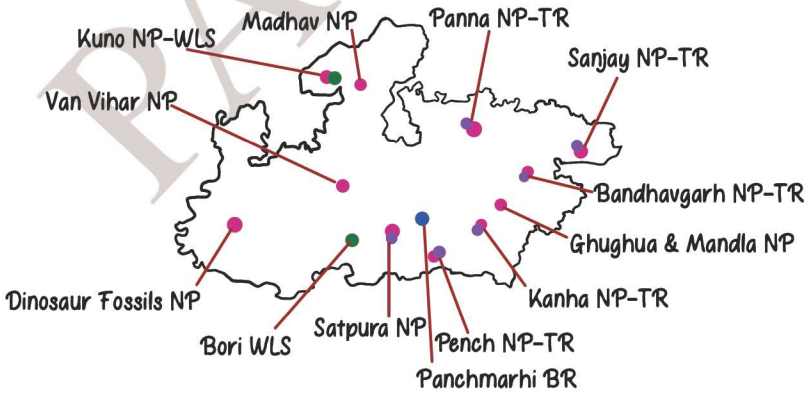
Uttar Pradesh



Bihar



Madhya Pradesh

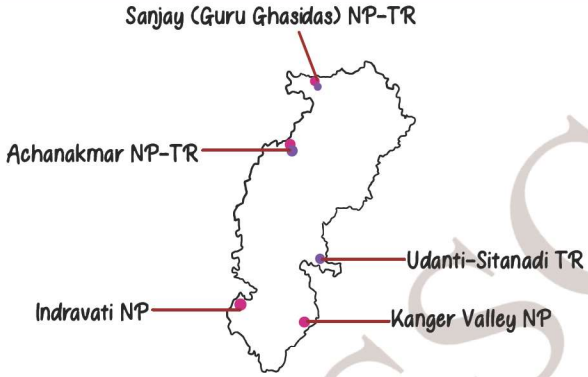


* Madhya Pradesh has most no of National Parks
* Cheetahs were brought from Namibia to Kuno NP as a part of Project Cheetah

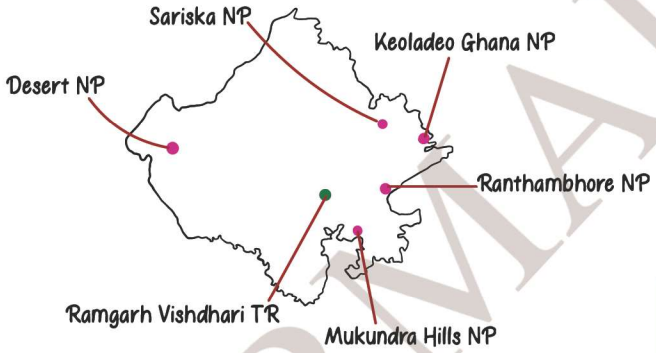
TRICK
- Sanjay: Sanjay NP
- Madhav: Madhav NP
- Paan: Panna NP
- Khake apne
- Bandhu: Bandhavgarh NP
- Kanha: Kanha NP
- Se milne
- Paanch: Panchmarhi BR
- Paise leke
- Saat: Satpura NP
- Baje
- Van: Van Vihar NP

→ Madhya Pradesh NPs

Chattisgarh



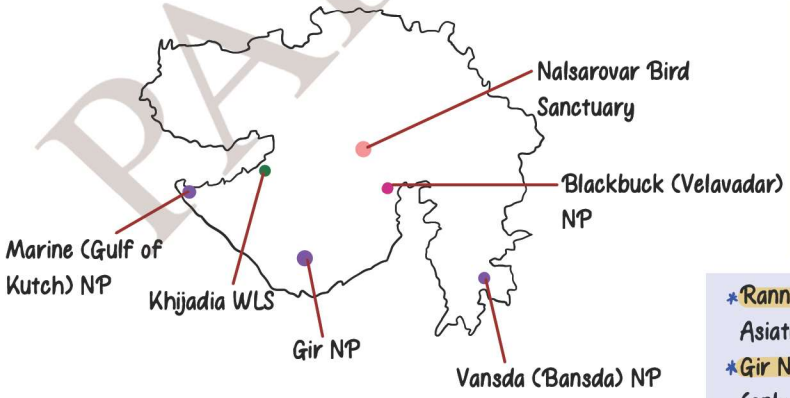
Rajasthan



TRICK
- Raja
- Mukund: Mukundra Hills NP
- Is Running: Ranthambhore NP
- In Saree: Sariska NP
- In Desert: Desert NP
- Lekin
- Kyu: Keoladeo Ghana NP
- Kyunki
- Ram ne Vish pi liya: Ramgarh Vishdhari TR

* State bird: Great Indian Bustard (critically endangered)

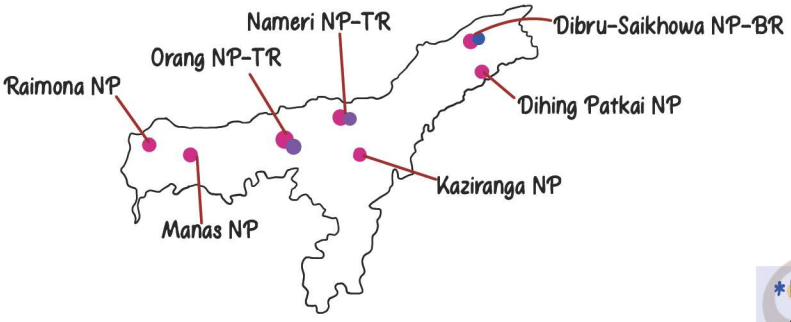
Gujarat



TRICK
- Gujarat
- Me Meri: Marine NP
- Black: Blackbuck NP
- Van: Vansda NP
- Beach par
- Gir gai: Gir NP

* Rann of Kutch is known for Asiatic wild ass (Endangered)
* Gir NP: Famous for Asiatic Lion (only seen here)

Assam

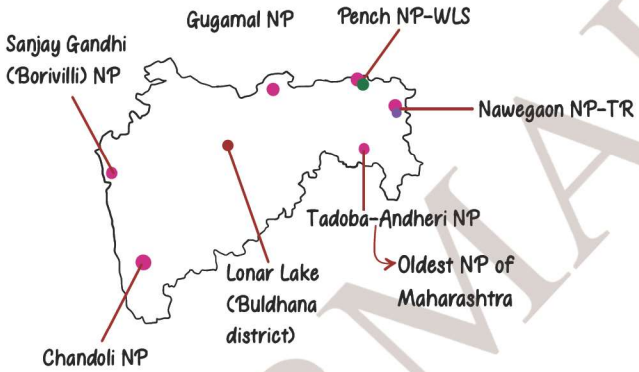


TRICK

- Mana: Manas NP
- Na Meri: Nameri NP
- Kazi karwadi: Kaziranga NP
- Mona ki: Raimona NP
- Aurang: Orang NP
- Sheikh: Dibru-Saikhowa
- Ke sath

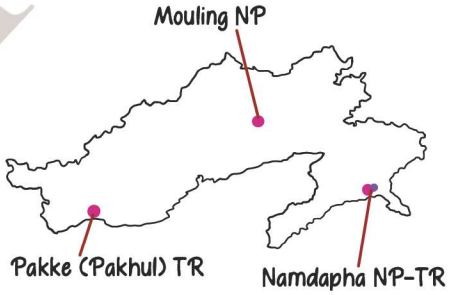
*Kaziranga NP: It has the largest population of one-horned rhinoceros

Maharashtra

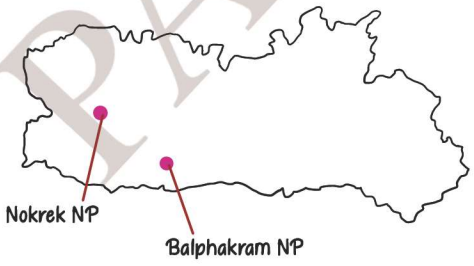


*Pench WLS: India's first Dark Sky Park

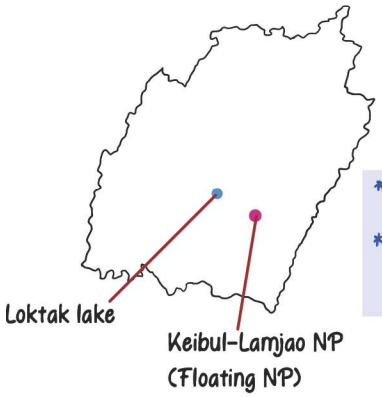
Arunachal Pradesh



Meghalaya

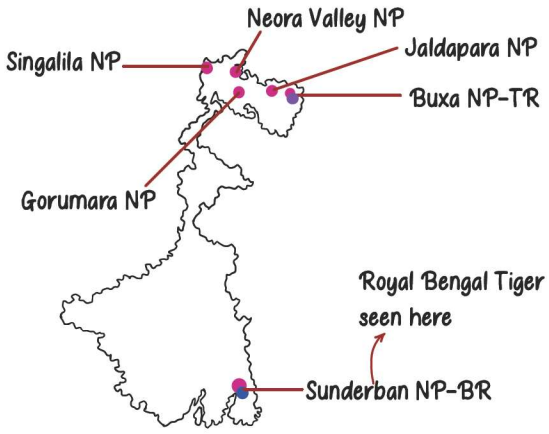


Manipur



*State animal: Sanghai deer (Seen in Keibul-Lamjao NP)
*Phumdis (Floating islands) exclusively seen in Loktak Lake in Manipur

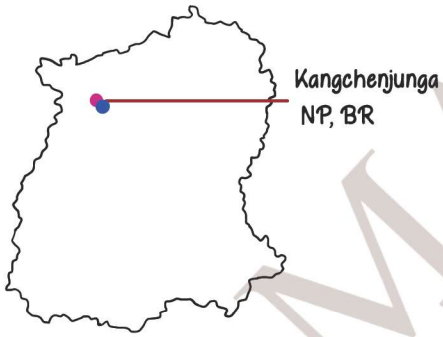
West Bengal



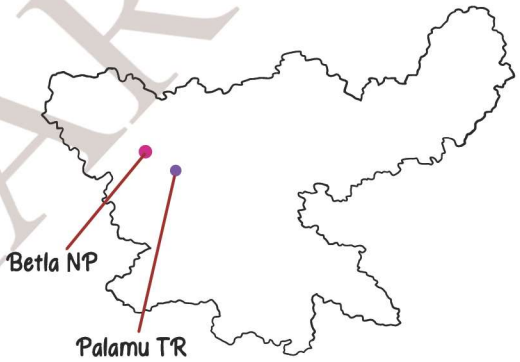
TRICK

- WB ki
- Jalpari: Jaldapara NP
- Nora: Neora Valley NP
- Badi Sundar: Sundarban NP
- Gori: Gorumara NP
- Hai aur
- Single: Singalila NP
- bhi kyunki
- Boxer hai: Buxa NP

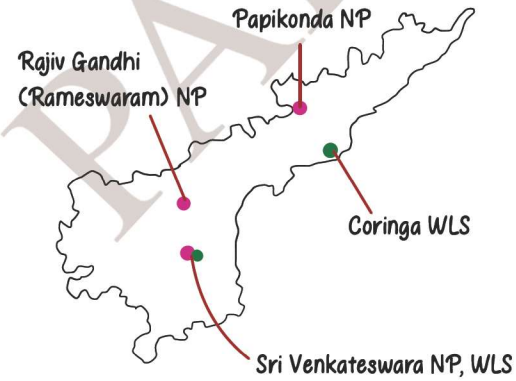
Sikkim



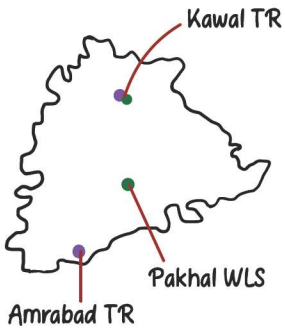
Jharkhand



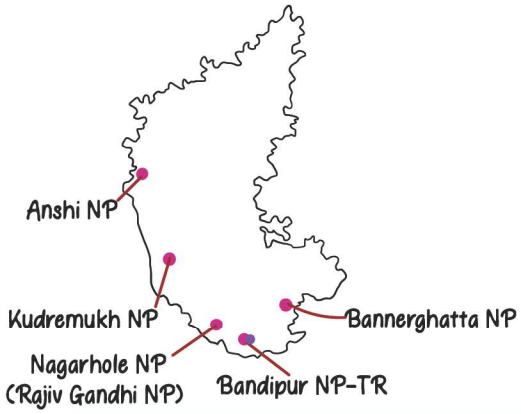
Andhra Pradesh



Telangana



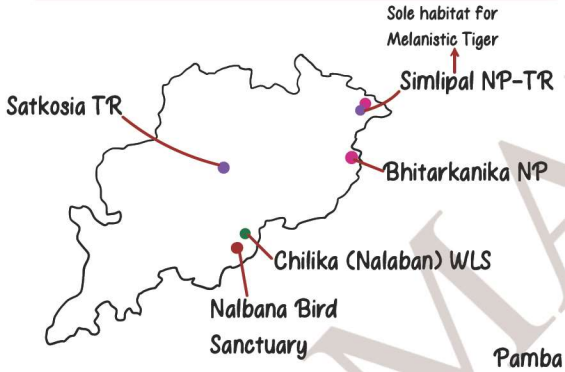
Karnataka



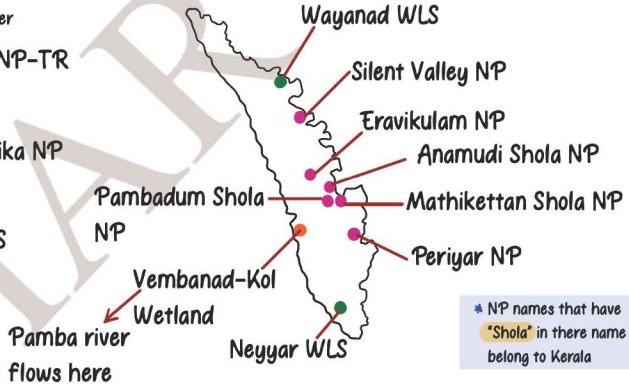
TRICK

- Bandi: Bandipur NP
- Nagar: Nagarhole NP
- Me Kude: Kudremukh NP
- Ka ek
- Ansh: Anshi NP
- Bhi Ban: Bannerghatta NP
- Hai

Odisha

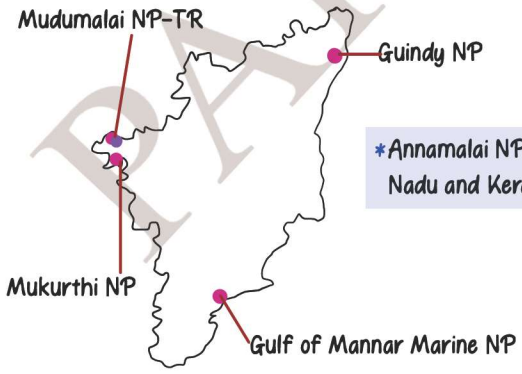


Kerala



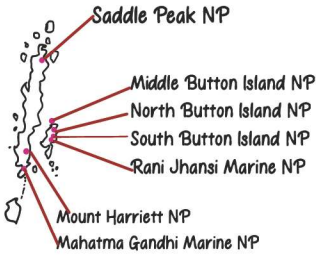
* NP names that have "Shola" in there name belong to Kerala

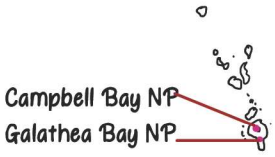
Tamil Nadu



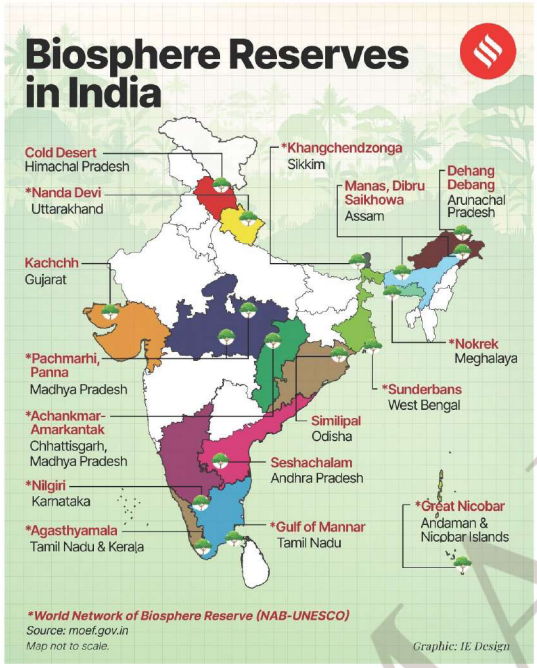
*Annamalai NP-TR: Tamil Nadu and Kerala border

Andaman & Nicobar Islands





Biosphere Reserves



- 1st Reserve Forest of India: Satpura National Park (also known as Satpura Tiger Reserve)
- **Total Biosphere Reserve**: 18
- **Oldest BR**: Nilgiri BR (spread across Kerala, Tamil Nadu, Karnataka)
  → Western Ghats and Eastern Ghats meet here
- **Largest BR**: Great Rann of Kutch
- **Cold Desert**: Himachal Pradesh

Under UNESCO, MAB (1971) → 12

1. Nilgiri (1st under MAB)
2. Gulf of Mannar
3. Sundarban
4. Nanda Devi
5. Nokrek
6. Panchmarhi
7. Simlipal
8. Achanakmar–Amarkantak (Chhattisgarh–Madhya Pradesh border)
9. Great Nicobar
10. Agasthyamalai
11. Kangchenjunga (added in 2008); highest mixed first World Heritage
12. Panna (latest)